

# **An Investigation of Workplace Characteristics Influencing Knowledge Worker's Sense of Belonging and Organizational Outcomes**

von

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*This thesis is dedicated to my parents.*

# Abstract

Workplace design practitioners and organizational managers are increasingly noticing all the various aspects in which the workplace affects organizations and their employees. The studies on the relationships between the workplace, organizations and their employees are more focused on psychology or facility management than the socio-spatial perspective. Workplace design, configuration and spatial features impact how well and how much a company can benefit from its human capital. Although the concept of the relation of workplace to an organization is not new, it is relatively unexamined.

This thesis introduces a new set of spatial variables to workplace studies, following the concept of personal control. The discussed spatial variables effectively describe the features of workplace floor plan and the characteristics of a workstation. Furthermore, this dissertation develops a method that creates the link between workplace spatial setting and a sense of belonging, organizational outcomes – organizational commitment, work motivation, job satisfaction and work performance.

Based on the detailed statistical analyses of a field survey that included 336 participants from 16 organizations, a model of spatial features influence on sense of belonging and organizational outcomes was identified within this study. The research findings provide evidence for creating a workplace with a sense of belonging and better organizational outcomes through spatial design.

This dissertation is comprised of six chapters. Chapter 1, an introduction, provides a general study background, discusses the problems to be solved in the study, and proposes an approach to deal with the target problems.

Chapter 2 firstly reviews the current workplace studies related to spatial features. Secondly, it discusses the influence of workstation design on the human muscle system. Thirdly, it discusses the most relevant psychological issues at a workplace as stated by previous researches. Finally, the chapter reveals how a workplace affects the work of an organization.

Chapter 3 specifies how workplace influences an employee's sense of belonging and environmental control, and introduces the conceptual model. It also introduces the independent and dependent variables, generates research hypotheses.

Chapter 4 describes the field survey design, procedures and the participants. It also covers the initial data analysis of the field survey: how the survey instrument, the questionnaire, was developed, commenting on all the aspects it includes – spatial experiences, work motivation, commitment, sense of belonging, job satisfaction and work performance.

Chapter 5 is data analysis. This chapter discusses the research findings on workplace design features in relation to employees' sense of belonging, satisfaction with ambient physical environment, and organizational outcomes – commitment, work motivation, job satisfaction and individual work performance.

The final chapter summarizes the findings, comments on design implications of the research results, and draws conclusions. The dissertation ends in admitting the limitations of this research and discussing practical implications for future investigation.

**Keywords:** Workplace, Organization, Human capital, Personal control, Spatial features, Sense of belonging, Ambient environment satisfaction, Commitment, Work motivation, Job satisfaction, Work performance

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# Chapter 1

## Introduction

### 1.1 Background

#### 1.1.1 Knowledge work and knowledge worker

Myerson's team (2010) explained that the change of future workforce and work organization in the U.S. has been widely discussed in business and academia since the late 1960s. It was believed that the many identified transformations are sufficient to address a shift from an industrial to a modern economy. The new economy was characterized as 'post-industrial' 'knowledge' or 'information'. Barley (1996) stated that the joint use of scientific and technical knowledge, information management and service provision is the 'future prosperity'. The future will rely more on brains than on physical strength.

The emerging post-industrial society differed significantly from the industrial society in terms of economy, technology and society's structure. Its economy shifted from a large-scale industry to small-scale, research-driven high-tech industries. Due to technological advances, the new science-oriented industries became to the central force. In the post-industrial social structure, new principles of social stratification started to emerge. White-collar employees, professional scientific and technical workers became predominant. This resulted in a change of social relations at the workplace, towards higher interaction between people.

Williams (2007) explained that the traditional industrial organization contains more single-directional trends than modern post-industrialism. In modern post-industrialism, these trends that shifted from manufacturing to service; from blue-collar to white-collar; from machine to information technology; from industrialists to technocrats; and from large-scale firms to more flexible organizational structures. The rapidly increasing significance of accumulating, processing and transmitting knowledge were the key aspects among those unidirectional

movements. Therefore, commentators have named the post-industrial society as an ‘information society’ (Bell, 1973; Webster, 1995). A new focus on ‘information society’ was caused by the emergence and development of novel Information and Communication Technologies (ICT) and their influences on social and economic organization. Bell (1973) explained that the movement from industrial to post-industrial society led the industrial production based social structure to the primacy of ‘theoretical knowledge’. This was a result of a major change in social and economic connections towards modern societies. He argued, “Knowledge and information are becoming the strategic resource and transforming agent of the post-industrial society...just as the combination of energy, resources and machine technology were the transformational agencies of industrial society.”(Bell, 1980). When industrial society took over the traditional society, the sector of agriculture shrank while industry and services were expanding. The current shift was from industry and service society to the knowledge and information society. ‘Knowledge’ became a social wealth; “Knowledge workers who have the capacity to translate specialized knowledge into profit-producing innovations (products, technological and organizational innovations) are viewed as becoming the privileged group.” (Williams, 2007: 117).

The harbinger of post-industrial age, the shift to knowledge work and to knowledge-based competition, was the most important change in the world of work (Drucker, 1969, 1993, 1998, 2002). During industrial age, business competed through the ownership of products, equipment and plants. In post-industrial age, business competition was based on knowledge, and the leading social group of the knowledge society will be the knowledge workers. The term of ‘knowledge worker’ was first used by Peter Drucker in 1960s.

How to define ‘knowledge work’ and ‘knowledge worker’ is still a hot debate. Each kind of job is in some sense a knowledge work. And everybody is a knowledge worker because everyone’s work contains some form of knowledge. However, a broad definition of knowledge might be too inclusive, which would make the concept of knowledge work meaningless (Collins, 1997; Kumar, 1995). Thus, a narrower definition of knowledge work is needed. Winslow and Bramer (1994) understood knowledge work as interpreting and applying information with the aim of adding value to an organization via innovating problem solutions and offering advices on improving management. Blackler (1995) categorized five distinguished knowledge types (see Table 1.1). Frenkel and his colleagues (1995) argued that using various terms enable to distinguish the nature of work from the perspective of contextual knowledge, and from the perspective of theoretical or abstract knowledge. They also claimed that knowledge workers rely on theoretical knowledge, and their work demand a high level of innovation.

Table 1.1. Blackler's knowledge types

Type of knowledge	Explanation and characteristics
1. Embrained Knowledge	Abstract, conceptual and theoretical information that people have in their heads. It can be applied to solve problems and think about issues in a creative way
2. Embodied Knowledge	Practical and applied ways of doing things, learned from experience
3. Encultured Knowledge	Shared understanding about how things are done in a specific location/situation
4. Embedded Knowledge	Systematic routines that mean a person can perform a task or activity without thinking; the task becomes second nature to the person to an extent that the knowledge, learning and skill behind it is submerged;
5. Encoded Knowledge	Information conveyed by signs and symbols

Scharmer (2001) further identified the framework of knowledge in a heuristic way (see Table 1.2). Meanwhile, Nonaka's group (2001) addressed another four types of knowledge: Socialization, Externalization, Combination, Internalization (SECI) based on the differences and similarities between Scharmer's codified and tacit knowledge: experiential, conceptual, systemic and routine (see Figure 1.1). Those knowledge workers were characterized to be task-specific and highly specialized, with good cognitive and technical skills, possessing a combination of embrained, embodied and embedded knowledge, and aggressively marketing of themselves. Therefore, knowledge workers were different from liberal independent professionals, such as architects, lawyers and doctors; and distinct from organizational professionals, such as managers, administrators and technicians, who depend on embedded and encultured knowledge. Reed (1996) defined knowledge work as the 'expert work' that performed by specialists. This kind of knowledge worker was labeled 'entrepreneurial professionals', such as business and financial consultants, project engineers, computer analysts and media consultants.

Table 1.2. Scharmer's knowledge forms

Form of Knowledge	Explanation and Characteristics
1. Codified Knowledge	The knowledge that has not been translated into disembodied symbolic forms and those that remain embodied
2. Tacit Knowledge	The knowledge that has not been translated into disembodied symbolic forms and those that remain embodied
3. Self-transcending Knowledge	Thought conditions that allow processes and tacit knowledge to evolve in the first place

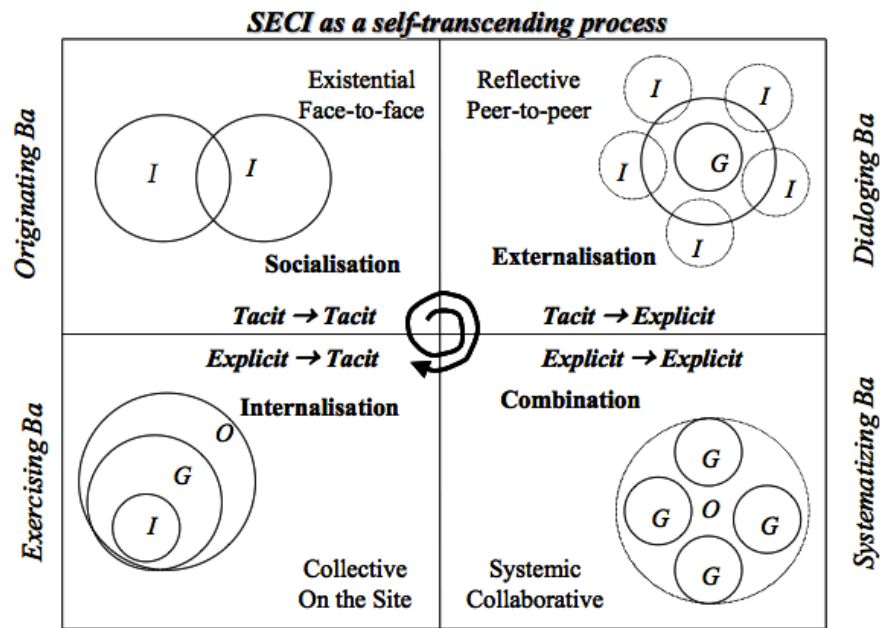


Figure 1.1 SECI model (Source: Nonaka et al, 2001)

Knowledge work and knowledge workers are emerging and growing with the new knowledge economy. The debate on the definition of knowledge work and knowledge workers will not end mainly due to the fact that the shift from industrial to knowledge work is by no means clear-cut. Also, knowledge work is hard to measure and map, since it is mostly invisible and takes place inside the knowledge worker's head. As a result, a lot of knowledge workers have realized that performing within the organizational structures, physical environments and technology systems is outdated and increasingly irrelevant to their needs (Myerson et al, 2010).

Knowledge workers are more economically important and more mobile than other types of office workers in 'knowledge age'. They move between different workspaces within buildings or between their clusters quite often. They are always alert to update their knowledge and keep it fresh. They think creatively and experimentally rather than organizationally. They are suspicious of formal hierarchy. And most significantly, knowledge workers are in scarce supply, which make employers nervous over brain drain or early retirement issues. Employers are therefore willing to invest more in expensive workplaces that will keep their knowledge workers happy and work effectively. One of the consequences of such investments is that organizations around the world have recently started experimenting heavily with workplace redesign. The problem is, people generally lack confidence to break out from traditional work settings. Also the organizations are not yet ready for a culture change and the successful cutting-edge. These are why not many knowledge workspaces have been introduced into use (Myerson et al, 2010). Moreover, the primary function of knowledge work is focus on collaboration with



others, which ignores the knowledge workers' need of concentrating on their own for long period.

In the present study, knowledge workers refer to brainworkers who make a living from knowledge. They are highly educated, professional and highly specialized.

### 1.1.2 Workplace design evolution

The modern office building has been emerged as the stereotypical place of work since 19<sup>th</sup> century for the post-industrial age (Becker, 1981). The needs of offices came with the administrative revolution that was caused by concentrating on enterprise and finance. During early periods, there were no proper buildings for administrative work, due to which office work took place in the houses of the owners of the industries (Danielsson, 2005). The growth and changing nature of office work had a huge impact on the design of office buildings.

Mechanical engineer and management consultant Frederick Taylor (1856 – 1915) dominated office culture from late nineteenth century to early twentieth century. His idea on industrial efficiency strongly affected the American office environment. Taylor made a great contribution to the study of working methods at the Bethlehem Steel Mills, Chicago. He published a book on scientific management named "*The Principles of Scientific Management*". The main concept presented in his book was to find general rules that can adhere to all types of office work and consequently generate principles to explain the work by office mechanizations. Taylor's groundbreaking opinion argued in the publication was that people are managed best if they are treated as unthinking automatons (Duffy, 1997). During and after the First World War, this concept was quickly adapted, and became widely used as routine-based work with strict hierarchy and supervision through management dominance. There were several reasons for the new ideas taking off so well: lack of workforce; fast growth of administrative work in business; women entering the labor market, to name a few (Ahlin & Westlander, 1991; Bedoire, 1979).

Taylor's ideas were translated into architectural design, for instance, creating vast open office spaces for the general work performance with large regular desks facing the same direction crowding the room. At the same time, single rooms were used for more qualified works. The most famous open plan office building is the Larkin Building



Figure 1.2 Larkin Building, Buffalo, New York, 1904 (Source: Duffy, 1997)

(see Figure 1.2), in Buffalo, New York. It was designed by Frank Lloyd Wright, the first architect to use the open plan design. The Larkin Building was built at the beginning of 20<sup>th</sup> century. It presented a novel stand on workplace layout with the aim to optimize the working process and reflect the hierarchy of the organization. The Larkin Building was owned by a mail-order enterprise. A Bullpen is located in an atrium where workers sit in rows of small desks face-to-face to each other; only the managers and supervisors have their own enclosed workplaces separated by glass walls. In order to bring daylight and fresh air into the building, it was equipped with a skylight and an air-conditioning system.

A rectangular high-rise office building with glazed facades, also known as ‘glass box’, became popular after the Second World War. The glass façade was the most noticeable feature of this type of building, which was valued by the modernists for its continuous and light appearance (van Meel, 2000). Meanwhile, novel technologies, such as air-conditioning systems and fluorescent lights were introduced into office buildings. These introductions led to changes in the interior of office buildings. The floor depth of these buildings was no longer limited by the need for daylight and natural ventilation (Sundstrom, 1986), and creating a high-rise building with deep and open floors became possible. Another benefit of a deep floor was economical and easy to rearrange, which enables to cut the cost of space and maximizes organizational profit and efficiency.

In the 1960s, a German team named Quickborner, lead by Wolfgang and Eberhard Schnelle, developed ‘Bürolandschaft’ (office landscape) that involved open plan layouts. It used traditional furniture, curved screens, large potted plants, and organic geometry to create space for work groups on large and open floors (see Figure 1.3). The landscape was the first spatial expression that paid attention to increasing communication flow between individuals and groups. The Sundstrom group (Sundstrom & Sundstrom, 1986) argued that this idea was developed based on human movement interactions following the philosophy of management. The critical promise of ‘Bürolandschaft’ was that “It seemed the closest approximation to a service which it was felt architects and interior designers were failing to supply – the detailed planning of interior space by people who understood something of design and organizational structure” (Duffy, 1992). The ‘Bürolandschaft’ attempted to achieve more efficient organization by increasing information interaction and transaction between employees (Christiansson & Eiserman, 1998). A better lighting system, the application of a central air-conditioning system in an office building and well-designed acoustic ceilings made this concept possible. The first office landscape was designed for the office building of Bertelsmann (see Figure 1.4) in Gütersloh.

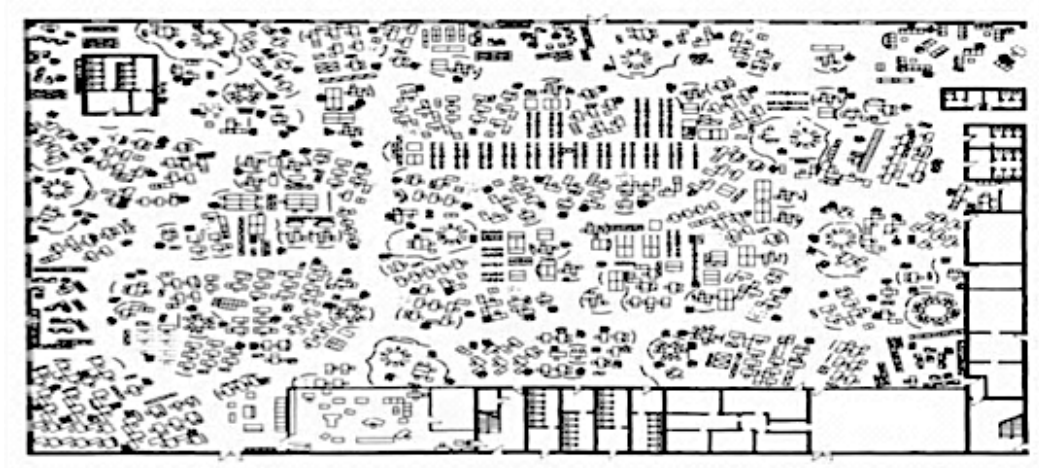


Figure 1.3 Workplace layout of office landscape  
(Source: Laing, 2006)



Figure 1.4 The interior of Bertelsmann  
(Source: van Meel, 2000)

The popularity of office landscape faded in the early 1970s. The oil crisis sharply increased the cost of space heating and lighting for maintaining office landscape. Besides, employees had started to complain about the unpleasant physical work environment conditions. The users' rejection of office landscape gave preference to cellular offices (see Figure 1.5), where employees have private offices with individual control of climate, access to daylight and outdoor view. However, the cellular office requires more space, which does not relieve economic pressure on the organization. This made architects and clients search for new solutions. Ake Beijine created a combination of cellular office spaces and the open plan space, namely the 'combi-office' (see Figure 1.6). In small cellular rooms, employees could work privately without interruptions from the outside. The open spaces located in the middle of the

building are equipped with facilities, which can promote interaction between employees.

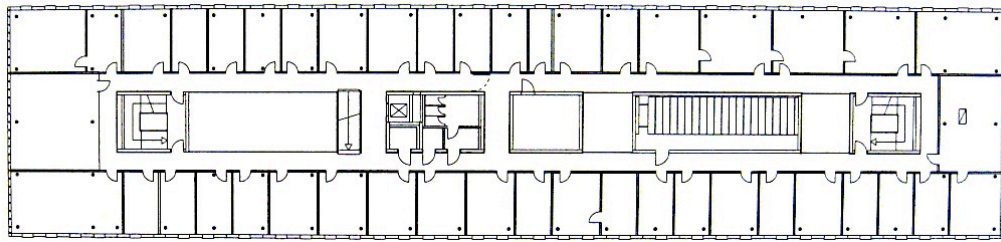


Figure 1.5 Example of cellular office  
(Source: Schittich, 2013)

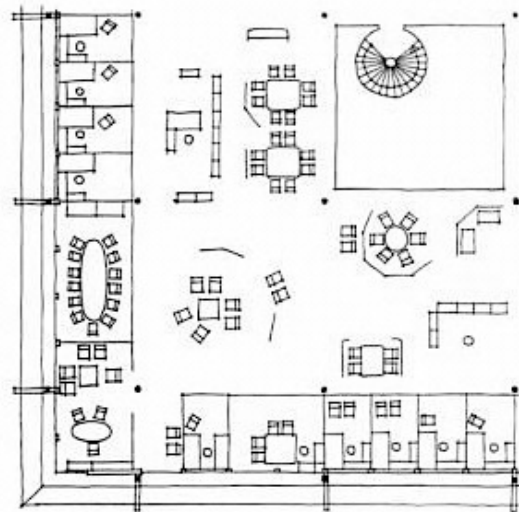


Figure 1.6 Example of combi-office  
(Source: van Meel, 2000)

At the time of development of information technology (IT), the wide use of personal computers (PC) in offices was expected to become the driving force for the changes in office design. This development had a huge impact in London, the financial capital of Europe, where the use of computers in financial services rapidly changed business conditions. New office buildings (see Figure 1.7) with large open floors equipped with air-conditioning systems were required for accommodating the computerized trading and IT infrastructure.

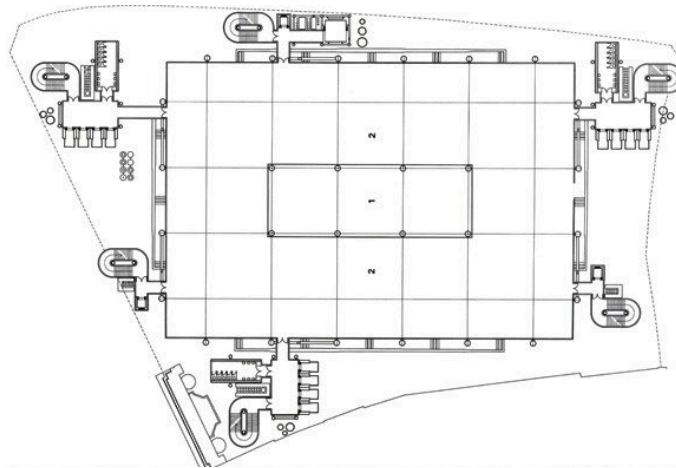


Figure 1.7 Trading floor plan for Lloyd's of London  
(Source: wallpaper.com)

However, the influences of using PCs in office design were very limited in Northern Europe. Instead of information technology, occupant's satisfaction and well-being were the primary focuses in office design. The cellular workplace layouts remained and continued providing employees with private space, individual control, natural light source and ventilation. The capability to open the window and access outdoor view was considered important. According to this tendency, human scale based cityscape was introduced into office buildings. The SAS headquarter is one of the most famous buildings (Figure 1.8-1.9).

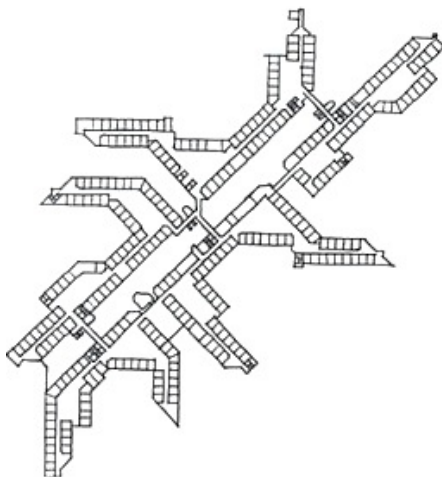


Figure 1.8 Floor plan of SAS headquarter  
(Source: cityofsound.com)



Figure 1.9 Main streets in SAS Building  
(Source: cityofsound.com)

After a decade, 'working smart' with information technology, like mobile phones, laptops, Internet, and e-mail became commonly used in daily office work. Office work was no longer restricted by place and time. Employees became more flexible to work at anywhere and at any

time. These developments provided various possibilities for office design.

In the 21<sup>st</sup> century, the climate change and the shortage of natural resources became a global issue, which drove office design into a new direction – ‘green’. The pioneers from the Center for Building Performance and Diagnostics (CBPD) at the Carnegie Mellon University started to apply energy-efficiency strategies in workspace design for improving building energy performance, occupant health and productivity. The applications of new technology in office buildings were not only changed the building forms, redefined the building envelopes and the interfaces between the external and internal environment, but also reshaped the workplace from the inside. Moreover, CBPD’s plug-and-play infrastructure systems made flexible layout possible and easy to change (Hua, 2007). ICT was another significant factor to advance workspace design and space management. It led a new way of working, whereby teleworking and digitalized work tasks became common. With the use of ICT more work tasks could be carried out remotely. Combining work time to meeting time in meeting room, individual workstations were not occupied for 45-50% of the time on average in a typical workday (Steelcase, 2002). The solution of space efficiency was providing workplace to 50-80% of the actual number of total employees in this type of workspace (Harrison et al, 2004). Combining with teleworking, group coworkers shared work areas by reserving available desks when someone needs to work in the office.

### **1.1.3 Human capital and physical workplace relation**

Theodore W. Schulz defined human capital as useful knowledge and skills that obtained by people in the processes of vocational and technical education (Berker, 1993). Therefore, human capital was regarded to be a resource, labor force. Various factors influenced human capital in an organization. The physical work environment was one of these. It had an important mediating effect on the relation of organization to its human capital. According to Vischer (2010), the physical environment accommodated the relations between the employee and the employer, organizational policies, job design, company values and organizational structure, etc. It consisted of design, interior space layouts and features that employees occupy and use for performing work tasks.

The space and spatial elements transmit and mediate social norms and cultural norms in an organization. The social context within the organization includes the interactions among employees, social support systems, social norms, and social expectations between groups. Furthermore, the symbolic function of the space works as a very important communicator of organizational culture and values, as well as an expression of hierarchy. For instance, bigger and more private individual space represents a higher level of organizational status; a more



open-plan workplace facilitates interaction and communication and also indicates organizational policies of promoting collaboration or coordination.

Workplace design, configuration and spatial features impact how well and how much a corporation can benefit from its human capital. For instance, workplace as an organizational resource to connect workplace design decisions with corporate business goals (Fischer, 1997; Guillen, 1997); workplace as a tool for providing support for employees' daily work and task performance (Leaman & Bordass, 2001; Vischer, 1996); and workplace as a mediating effect on the creation of intra-organizational relations in a way of forming organizational interaction and a social network (Stephenson, 1998; Kampschroer & Heerwagen, 2005).

Vischer (2010) pointed out that while workplace in relation to organization is not a new concept, it is a relatively unexamined one. She explained the conventional point of view that workplace is a cost to an organization, which was initiated and developed by real estate industry. Based on this aspect, workplace was considered to be the investment in property rather than in human capital. Since the trends of knowledge economy have appeared, these tendencies have had an impact on organizations and workplace as well as the corporate view on human capital.

Huge numbers of temporally occupied offices and meeting rooms appeared in large accounting and management consulting companies. This reflected an economic fact that professional and technical employees spend more time in their clients' office rather than in their own offices (Vischer, 2010).

However, few companies took advantage of workplace change or move to improve the relationships between human capital and workplace (Ouye & Serino, 2004). These advantages could be better customer relations, enhancing productivity, creating opportunities for learning, mentoring and developing a consolidated community and culture. Concerning four basic relationships (poor, neutral, positive and active) between an organization and its physical work environment was helpful to define how well the workplace attains human capital related objectives (Vischer, 2010). The poor relationship indicated that the workplace hinders work, adding no value to business, i.e., distractions caused by noise or people who move too often, or a workplace that is too crowded. The neutral relationship was less adverse to employees' work activities. When the workplace improved workers' capability of work performance and supported their work or tasks, the relationship became positive. The ideal situation between the organization and the workplace was an active one where organizations gain maximum value from workplaces.

Companies increasingly believed that dynamic and supportive workplace plays an active role in succeeding business because workplace can work as a strategic instrument in the

implementation of organizational policies, symbolizing mutual commitment, and providing environmental control to employees.

As Vischer (2010) has shown, from the socio-spatial perspective, territoriality, environmental control and job performance were the most crucial and unexamined assumptions. The joint requests of territoriality and environmental control often led employees to resist workplace modifications, even though these changes were aimed to improve work process and efficiency, achieve better use of human capital in organization. Non-surprisingly, workers resisted non-territorial experiments in some companies, like hot desk, mobile or remote office.

Spatial features influence social relations within an organization in different ways. The workplace provides necessary tools for work task performance, but also the social status in the organization according to its symbolic function. According to the function of symbolism, the number of walls or partitions, the height of these partitions, proximity to windows and the outside, as well as the proximity to the chief offices are the critical indicators of social status. The optimized workplace can support, facilitate and consequently enhance employees' daily performance. It is also flexible and easily adapted for group work reconfigurations and moves, as well as the unexpected facility expansion. These are all essential concepts for organizational effectiveness. Since corporations shift from a more stable environment to a more competitive and unpredictable environment, the workplace is desired to be more flexible to provide a better fit between human capital, organizational policies and workplace strategy.

People's work and daily activities are very important to human capital. Besides, their skills, creativity and the connection to or interaction with co-workers also play a key role in human capital. The number of well-designed collaborative workplaces is increasing in companies, because project-based teamwork for creating and sharing new concepts, new knowledge through formal or informal networks has started to grow. Knowledge creation and sharing can be directly influenced by workplace design. The combined or cooperative workplace offers opportunities for the knowledge initiating cycle: socialization, externalization, combination and internalization (Von Krogh et al, 2000). For Vischer (2010). Although socialization emphasizes on the individual, it is not an isolated activity. It contains interaction like sharing experience with others. At the same time, externalization relies more on verbal communication to make others understand and apply it. Thus, it needs a place to host this activity. Combination usually takes place in shared workplaces and diffuses throughout the organization since it generates new knowledge across groups of employees. Internalization, on the other hand, needs activities, such as training and exercise, and largely takes place in a workplace designed for a particular purpose.



## 1.2 Problem statement

Researchers have revealed many benefits of workplace to individuals and organizations. Current studies of workplace in relation to the employee and the organization are typically approached from the psychological or the facility management perspective, a few attempts have been made from a socio-spatial point of view. The architectural causes of sense of belonging and organizational outcomes, especially organizational commitment and work motivation, have been little discussed.

Architects rely on either precedent experiences or well-known design guidelines for workplace strategies. Despite decades of workplace research, there was little empirical evidence of office design from the perspective of human capital. Current available workplace standards mainly emphasize on the quantity of space geometry or the physical-technical features, i.e. the specified space need per person in a cellular office is 10-17 m<sup>2</sup>, room depth is 4.50 – 7.00 m with width of 2.5 – 3.1 m; the proportion of natural lighting in a cellular office should be 100 % with individual controlled natural indoor climate (Schittich, 2013). Both the quantity and quality of workplace as set in current codes and guidelines are based on the concerns over building performance and human physiological comfort. ‘Workplace quality’ generally refers to all the factors in a work environment associated with the building performance or comfort according to task and work performance and activities, including office type, geometries used for defining a space, lighting condition, thermal condition, acoustic situation, etc.

However, workplace occupants do not only need a safe and comfortable place for conducting work, but they also must pursue satisfactory conditions in their organization. Unfortunately, guideline-makers have ignored the fact that man is emotional and complex. Architects have no reference by which their design would be able to take into account the way workplace design affects occupants’ individual needs, such as sense of belonging, organizational commitment and work motivation. The current measures do not necessarily ensure good workplace design if the individual and organizational requirements for a workplace are ignored.

In summary, current workplace studies and design guidelines are fairly inadequate in offering advices and providing solutions for workplace design, while office workers’ and organizations’ demands are not taken into consideration. Hence, a broader meaning of workplace quality must be developed. Fischer (1983) and Sundstrom (1986) argued that the sense of belonging is a better measure of workplace quality than either comfort or effective task performance.

Since the nature of current office work is knowledge intensive work, most of the competitions between companies are the competition of human capital. According to this reality,

organizational commitment and work motivation should be taken into account for the measure of workplace quality as well. Unfortunately, the architecture causes of organizational commitment and work motivation are barely found in literature.

### **1.3 Research objectives**

This research has two purposes. First, it examines workplace design factors by measuring knowledge workers' sense of belonging and organizational outcomes at workplaces. All these variables are interrelated. The aim is to find out the ways for, as well as the weight of, spatial elements that affect the employees' sense of belonging, satisfaction with ambient physical environment and organizational outcomes – commitment, work motivation, job satisfaction and work performance. This approach will bring together the individual and organizational aspects of workplace design and illuminate their potentially critical roles in ordering and enriching the architectural workplace experience.

Secondly, the study results are used for establishing a model of the impacts of workplace spatial settings on the sense of belonging and organizational outcomes. Underlining why workplace design needs to reflect the concept that employees' and organizations' demands are significant design criteria alongside physical design variables. It also suggests that executives and managers take the advantage of opportunities provided by workplace design to add value to their organization and maximize human capital. This study does not only propose a research methodology, but also develops a useful tool for promoting organizational effectiveness.

### **1.4 Methodology**

In studying workplace design, previous research has suggested the use of office type (Bodin Danielsson, 2010) and layout (Leblelici, 2012; Woldfeld, 2010) to describe the relationships between workplace, occupants and organizations. In this study, the author proposes workplace design constructs according to personal control over workplace as independent research variables. These spatial elements will contribute to the definition of the workstation, and the decision of workplace configuration as a whole. In the first place, this study attempts to emphasize the people's spatial experience related to proposed design constructs (independent variables).

The study is based on a proposed concept model that suggests a potential link in which the workplace provokes the people's sense of belonging and satisfaction with their ambient physical environment, as well as the consequent organizational outcomes. Therefore, the employees'

sense of belonging, satisfaction with their ambient physical environment and organizational outcomes are the main research variables (dependent variables) in this study.

To attain a comprehensive understanding of the relationships between the workplace, the employees and their organization, subjective measurement is used – data collection through self-report, but do not limit data collection to self-reported opinion. The research techniques that have been developed and validated by previous researchers have been employed to measure the sense of belonging. Fully understanding the ways in which employees consider their workplace and how they feel themselves there enables to improve workplace quality with organizational goals from an architecture design perspective.

## Chapter 2

### Literature Review

#### 2.1 Spatial characteristics of workplace

##### 2.1.1 Open-plan, enclosed or mix

Debates on whether to prefer an enclosed private office or an open-plan workplace have been ongoing since the open-plan office was invented in the late 1960s. Conventional workspace designs prefer to create a completely closed office (private space) for employees. Whereas, partitions or cubic workstations are increasingly used instead of solid floor-to-ceiling walls and internal boundaries in modern office designs to create open-plan space. According to the International Facility Management Association (IFMA) survey among the members, besides open plan, private and ‘bullpen’ office, and a mix of spaces is common in these companies. A well-chosen mix space can make an organization unique in terms of reinforcing cooperated culture, structure, branding and objective (Herman Miller Inc., 2008).

##### Open-plan office

An open-plan office is a single large office space without dividing walls or doors that has been divided into separate zones only with furniture, (see Figure

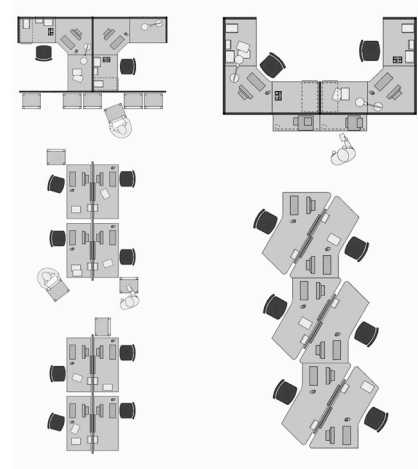


Figure 2.1 Open-plan office (Source: <http://www.immonet.at/en/open-space.htm>)

2.1). The workplaces are equal for all and the hierarchy is flat. The office landscapes predominantly consist of changeable room structures. For instance, zoning through mobile walls, cabinets and room-in-room systems. Open-plan spaces have an open, transparent effect, and high flexibility for the reproduction of various organizational structures. They are particularly susceptible to the demands of change by employees through room-in-room systems and movable walls.

The open-plan office is believed to be able to promote communication and interaction between employees, also flexibility. Communication beyond the boundaries of work and faster processes through direct decision-making channels could encourage informal discussions in a central arrangement of discussion, technical equipment and regeneration areas. These all help to integrate all people at the workplace and strengthen the feeling of 'we' via the open structures that enable visual connection and accessibility to colleagues. Open-plan designs have the ability to house more employees within limited space, reduce set-up and renovation time, reduce employee misconduct, allow more daylight into deep buildings, and cheaper to heat.

However, there is not enough empirical evidence to support these widespread beliefs (Kaarlela-Tuomaala *et al.*, 2009; Smith-Jackson & Klein, 2009). One of the consistent findings from the user surveys at workspaces was that workers were not satisfied with an open-plan office. The reasons for this dissatisfaction may be noise, distraction, or lack of privacy (Vischer, 2008). Also, the lack of withdrawal possibilities is not suitable for concentrating on individual work. According to a study carried out by Salter and his colleagues (2003), most workers reported that 'speech privacy' was the biggest problem in an open-plan office. They suggest that rather than foster more useful conversations; the room may actually inhibit these. Johnson and Evans' (2000) study demonstrated that the constant distraction of colleagues' noise dampened employees' motivation. Moreover, the modern open-plan office was full of cubicle partitions and lack of distinctive features. This failed to support orientation and way finding, and sent employees a message from their employers that everybody in the office is the same. Therefore, employees might feel interchangeable and were more likely to feel that their job is temporary (Vischer, 2010).

#### Enclosed office (Cellular office)

The cellular office is the most traditional form of office. The history of the enclosed cellular office can be traced back to the beginning of administrative work. It is a private office that is arranged in rows along the façade of the building. Each room has space for 1 to 6 employees (see Figure 2.2 and Figure 2.3). The rooms are internally connected by corridors that are purely traffic surfaces.



Figure 2.2 Cellular office with 1 employee.  
(Source: <http://www.immonet.at/en/cellular-office.htm>)

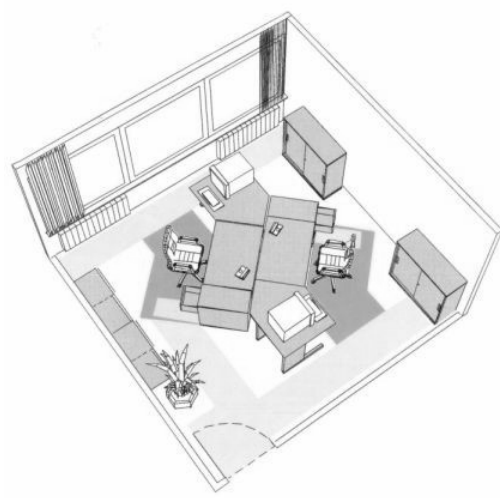


Figure 2.3 Cellular office with 2 employees.  
(Source: <http://www.immonet.at/en/cellular-office.htm>)

An enclosed office creates a high level of privacy for employees. It is appropriate for promoting work that requires concentration, and enabling intensive collaboration and communication within an individualized work environment. There is little or no disturbance in a private office. In double or small-group offices speech has the highest disturbance potential. Daylight, artificial light, temperature and ventilation can be individually regulated in an enclosed private office. Cellular offices can be designed individually to meet the needs of the organization, and to provide the opportunities for the personnel to contact their colleagues. Additionally, an enclosed private office can indicate the worker's value and status (Herman Miller Inc., 2008; Kupritz, 1998). Therefore, a private office is most likely provided to those employees who deserve to work in a private and quiet environment where they can perform the high-concentration-need work.

Nevertheless, the spatial isolation of a cellular office limits general information flow and knowledge exchange within colleagues. Also, it provides no stimulus for informal communication. Hence, the isolated groups may lack communication and transparency. Employees tend to move less and telephone more. The limited room area cannot house too many employees at the same time, which might increase the economic stress on rent.

### Combination office

The combination office combines the advantages of a cellular office and an open-plan office. Combining single and small offices together with additional common space that can be used for conferences, meetings or recreation (see Figure 2.4). Such offices make possible the frequent alternation between individual high-concentration-need work and the communicative task. They also provide employees with the possibility of stepping out of their own office to

stretch their legs without occupying the central traffic routes.

The mix of private and open spaces allows the alignment of workspace and the business strategy. It eases and fosters communication and connection within the group to enhance and speed up decision-making by proximity and open space configuration (Herman Miller Inc., 2008). Such space can be used as a mediator—for sending a message, or for reinforcing the current culture or changing into a preferred culture. Certain type of work will happen within such space, which also functions as a stage for organization development.

However, due to the building depth requirement, combination office cannot be applied everywhere. Also, office doors cannot stay open because of the noise level in common spaces.

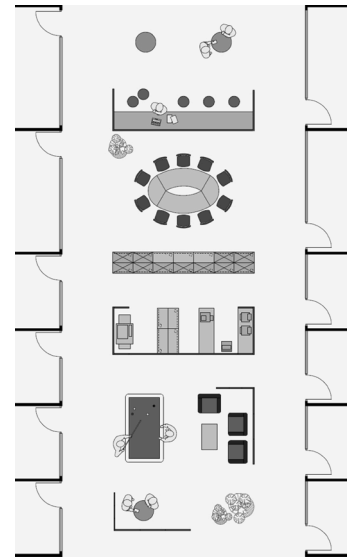


Figure 2.4 Combination Office  
(Source: <http://www.immonet.at/en/combination-office.htm>)

### 2.1.2 Density

The architectural ‘density’ refers to the amount of square meters that available to a person in the office. A typical psychological definition of density is the number of people located within certain distance of a target employee, and represents the potential interactions and/or interferences among employees (Fried *et al.*, 2001). Psychological density is usually associated with architectural density.

Researchers have found that workspace density can affect employees’ behavior negatively. For instance, higher workspace density could lead to more uncontrollable interfering contacts (Evans, Johannson & Carrere, 1994), could decrease employees’ experience of control at work, and decrease their ability to concentrate and finish their work task (Oldham *et al.*, 1995). Consequently, high dense work settings are likely to reduce employees’ work performance, job satisfaction and organizational commitment (Evans, Johannson & Carrere, 1994; Sundstrom, 1986). Moreover, Fried, Slowik, Ben-David and Tiegs (2001) indicated that workspace density negatively associated with the employee’s reactions to higher job complexity and organizational tenure, which is considered as a predictor to individual knowledge in an organization.

In contrast, Szilagyi and Holland (1980) found that workspace density also has positively effects in their field experiment with professional workers: increasing workspace density can positively impact work satisfaction, can increase information exchange, facilitate task performance, and erase conflict and misunderstanding.

As Becker (2000) showed, while a company is facing cost pressure, for many organizations

raising density is almost always the first approach to reduce the cost. Density varies in different office types within and across business units. The more enclosure, the larger the required size range. Team-oriented 'bullpens' and pods require less space than high-paneled cubicles or closed offices. So the former reduces cost in an effective way. For instance, a space of 929 m<sup>2</sup> enables to house 90 workplaces (4.6 m<sup>2</sup> each) in 'bullpen' configuration, 60 workplaces (7 m<sup>2</sup> each) in pod configuration, 45 cubes (9.3 m<sup>2</sup> each), or 30 offices (14 m<sup>2</sup> each). At an assumed annual rent cost of \$ 200/m<sup>2</sup> the difference in cost per employee can range from \$ 2,200 to \$ 6,600 (Becker, 2000).

Becker (2000) further suggested that more team oriented 'bullpens' and pods are helpful in enhancing work effectiveness while decreasing cost. More open environment implemented on a small and team-oriented scale would create opportunities for communication and work-concentration, and lower the cost due high density. Nevertheless, employees might experience more distractions and interruptions in more open environments compare to relative closed spaces.

### **2.1.3 Enclosure**

The rate of enclosure is determined by the height of workspace dividers (Goins, Jellema and Zhang, 2010). Higher dividers offer a higher enclosure level. Previous research suggested that increasing job complexity might associate with greater physical enclosure (Sundstrom *et al.*, 1981). This could be a reflection of the tendency that physical enclosure should be given to employees whose jobs are complex. Greater physical enclosure allows them to concentrate on their work better; whereas employees, who do routine jobs, might be placed in a relatively unenclosed workplace to allow easy supervision (Sundstrom *et al.*, 1982).

Lee's study (2010) carried out in an enclosed private office, an enclosed shared office, an open-plan office and a 'bullpen'. It was found that employees in the high cubicles announced lower satisfaction in terms of visual privacy and interaction with coworkers, noise level, sound privacy, job performance and perceived acoustic quality than employees in enclosed offices. This study also addressed that people work in 'bullpen' or open-plan office without partitions showed significantly higher satisfaction with noise level, higher work performance and higher perceived acoustic quality than those who work in cubicles with high or low partitions. Additionally, the 'bullpen' demonstrated higher satisfaction than high cubicle in terms of sound privacy. And no difference was detected comparing to enclosed offices in terms of privacy, interaction and acoustic quality.

Brand and Smith (2005) conducted a set of field studies to investigate occupants' perceptions of occupancy quality, job satisfaction and job performance at open-plan workplaces while changing partition height from 60-64 inch to 36-42 inch. They found that people moving



from high partition height to low partition height largely reported more negative perceptions in terms of privacy and sense of control at their immediate work surroundings. Moreover, people whose workstation had low panel height voted significantly higher perception of visual appearance, color, daylight and outdoor view quality. And not surprisingly, workers that work behind high partitions had a significantly higher perception of privacy, rated the general office layout, noise isolation and quality of ease oral communication better. Oldham's (1988) quasi-experiment demonstrated that workers that move from an open-plan office to a partitioned office experience significant improvements in task privacy, communication privacy, crowding, and office satisfaction. However, enclosure only played a minor role in predicting perception of privacy, distraction and communication, satisfaction and performance according to O'Neill's research (1994).

Architectural enclosure in workplace was found associated with perceived privacy (Sundstrom *et al.*, 1982). Goins and his colleagues (Goins, Jellema and Zhang, 2010) compared the effects of two physical variables of speech privacy and visual privacy, and two symbolic attributes of home-like atmosphere and work pride of architectural enclosure on employees' work performance by using a survey database that contains the employees' rating of their office components. Their study revealed that the height of the dividers was positively related to the ratings of speech privacy and visual privacy. But it did not affect occupants' ratings on home-like atmosphere or workplace pride. Furthermore, people specified that home-like atmosphere and workplace pride were more important than speech privacy and visual privacy in improving work performance.

#### **2.1.4 Window and outdoor view**

Windows are strongly desired in workspaces (Menzies & Wherrett, 2005; Morrow *et al.*, 1998). Not only because windows provide a source of natural illumination, but also because they enable a view to the outside world (Wells, 1965; Collins, 1975; Butler & Biner, 1989; Butler & Steuerwald, 1991); provide visual access to weather conditions, the sense of different seasons and the time change during a day.

An extensive interview with 235 office employees showed that the majority of people (74 %) prefer to have a window close to their workplace (Wotten *et al.*, 1982), whereas larger windows were more welcomed in offices. The preferred window size varies. The optimal size of preferred windows was from 1.8 m to 2.4 m in height and somewhat wider than taller (Galasiu & Veitch, 2006). The lack of windows demonstrated adverse consequences. A study by Finnegan and Solomon's (1981) revealed that occupants working in a windowless office rated their job less satisfactory than those who work in a windowed office. People that work in the windowless or underground spaces tended to suffer from somatic distress and fatigue, and

expressed more negative feelings about the physical office settings (Collins, 1975; Butler & Biner, 1989, Heerwagen & Orians, 1986).

Individuals tended to have a strong desire to have a view from a window on nature rather than on a building or an urban view. Having view on nature had positive effect on improving human sense of well-being (Farley & Veitch, 2001). A study (Kaplan, 1993) where 615 office employees were interviewed revealed that occupants with view on nature reported greater job satisfaction, less frustrated and more patient during the study period of 6 months. Furthermore, these office workers that work in a windowed office with a view on nature showed greater enthusiasm, deemed their job more challenging, and rated higher in overall health condition and higher life satisfaction. Visual and physical access to the green outdoor environment was found having a positive effect on both male and female employees' work attitude. Visual and physical access to the green outdoor environment decreased the male workers' stress level, however, the results did not support that the same would apply in case of female employees (Lottrup, Grahn & Stigsdotter, 2013).

Given the strong preference to windows with a view on nature, one might expect performance to be greater with natural views, however, empirical evidence did not support this notion (Stone, 1998; Farley & Veitch, 2001). It is debatable whether individuals who work in an office with a view on nature outside experience more comfort than in case of a non-natural outdoor view. Aries, Veitch and Newshman (2010) found that natural views directly increased the discomfort level and indirectly reduced the discomfort impression of an office. Moreover, view quality did not have a direct influence on comfort.

## **2.2 Workstation and the muscle system**

Particular attention must be paid to the workstation and facility design at a workplace on the proper work position. Because of employees who do not get enough exercise over the day may reduce the their daily output including health output and work performance.

Workstation design must follow various needs of the muscle system. In daily life, different parts of the human body operate together to perform different muscular activities. Sitting and standing are the most common postures used at work. There are a lot of work tasks that require people maintain a sitting or a standing posture at a fixed position. The typical work activities in a workplace, i.e. doing computer-related office work, oblige people to sit for a long period. Sitting in front of a computer screen for a long time puts much stress on the spine. Awkward work postures may result in errors, discomfort and work difficulties. People's capability of adapting to uncomfortable or difficult conditions are much more difficult than they need to.

Vision requests at work determine the workplace volume; body posture and task requirements determine the workplace of hands. Usually, operational controls are either done by hands or feet. Tools and devices must be designed in proper size and arrangement for hands so that the wrists or arms will not be in straining positions. Ideally, the computer screen should be positioned below the horizontal visual axis for a relaxing posture of the head. The viewing angle should be thirty degrees below the horizontal to meet the screen center.

“In work area, the workers’ body dimension and the work that needs to be performed determine the height of the work surface. The work surface should not contact the thighs or knees of a sitting person. The width of the work surface should leave enough clearance for legs and any items stored below the work surface. The depth should allow for posture changes and the repositioning of the monitor or other materials needed for work. The arrangement of the seat should be adjustable by the individual; adequate space should be provided for supporting body movements (i.e, clearance for legs) with the shoulders, elbows and wrists at neutral positions. A workstation must be easy to enter and easy-reach controls should be provided. Handles and grips should fit the user’s hand. It is essential to offer workers control over the modification of workstation elements, so these would fit their needs and capabilities.” (Bergh & Theron, 2007, p: 73).

## **2.3 Psychology of workplace**

### **2.3.1 Privacy**

Generally, privacy at work environments refers to “ the regulation of interaction with others, the freedom from control by others, and the process of information control” (Laurence *et al.* 2013; Kelvin, 1973; Altman, 1975; Stone & Stone, 1990). Based on this definition, privacy is a central process of regulation by individuals or groups that make themselves accessible and open to others in a varying degree (Altman, 1975). Workplace privacy has two levels: architectural privacy and psychological privacy. The former refers to the visual and acoustic isolation provided by the surrounding environment (Wang, 2009); the later is defined as the need of control over ones’ accessibility to others (Altman, 1975; Sundstrom, Burt & Kamp, 1980). Evans and McCoy (1998) demonstrated that visual and acoustic isolations and exposures are strongly affected by layout, circulation systems and the individual’s location in the workspace. Also, the level of exposure is influenced by the shape and orientation of an interior space (Evans & McCoy, 1998).

Wang (2009) described that perceived psychological privacy at workplace was usually associated with architectural privacy. Similarly psychological privacy correlates to the level of

enclosure, which was supplied by architectural elements or regulated by architectural configuration. Wang (2009) further explained that architectural privacy at workplace could be measured by the features of the physical environment, for instance, the height and number of partitions available for an individual worker. The highest level of architectural privacy in a workspace is working in an enclosed private office with four opaque walls (floor to ceiling) and a door. People who work in cellular offices are isolated from visual and acoustic distractions. They can decide on the accessibility of others and the interactions with others.

Privacy is directly related to comfort. Kupritz (1998) adopted a belief matrix to examine the influence of design items. It was constructed based on the significance of engineers' considerations of privacy in their work environments, regarding production engineering and manufacturing engineering. The results of the study showed that engineers prefer having their workstation located away from the main traffic flow so that only a minimum route would go through their work area. They described the workplace should be enclosed by partitions with height from 1.5 m to 2.1 m with a door. Floor to ceiling solid walls are considered to be significant characteristics to support privacy regulations. A study indicated that having more privacy and control over the accessibility by others, allowing employees to concentrate, and having collaborative workspaces are helpful to achieve functional comfort at a workspace (Vischer, 2006).

### **2.3.2 Stress**

Teasdale (2006) stated that stress is, among anxiety and depression, one of the most common mental health problems at the workplace. Stress arises when demands exceed one's capability to deal with or control these in the work environment. Stress itself is not a disease. However, long-term excessive stress is a very powerful cause of serious health problems (Teasdale, 2006). The consequences of stress to individuals involve fatigue, emotional instability, depression, excessive smoking, drug abuse or even suicide. Teasdale (2006) also indicated the influences of stress to an organization include reduced productivity, an increase in errors, lack of activity, poor decision-making, job dissatisfaction, disloyalty, an increase in sick leave, absenteeism or even organizational breakdown.

Another study (Rashid & Zimring, 2008) revealed that the physical environment is significantly associated with individuals' stress level at work. Indoor environmental variables (noise, lighting, ambient temperature, and air quality) and interior design variables (use of space, furniture, fixtures, material, environment graphics, etc.) induce stress by the ways in which they impact individual needs. For instance, the open plan workplace may reduce one's privacy, and the person's work performance may suffer as a consequence.

Both individuals and organizations can benefit from having contact with the green outdoor

environment at the workplace. Employees who had physical access to the green outdoor environment reported the lowest level of stress (Lottrup *et al.*, 2013). Having visual or physical accesses to the outdoor environment during a working day is helpful to decrease perceived level of stress (Lottrup *et al.*, 2013; Shin, 2007), increase job satisfaction (Leather *et al.*, 1998) and work performance (Kaplan *et al.*, 1996). A recent study (Lottrup *et al.*, 2013) found that employees who had physical access to the green outdoor environment at their workplaces reported a considerably more positive workplace attitude than those who had only visual access to workplace greenery. Employees who had neither visual nor physical access to workplace greenery displayed the most negative workplace attitude. Therefore, maximizing the outdoor view to natural elements and allowing physical access to the outdoor environment are valuable design strategies for workplace design practice that enables to reduce work stress levels.

## **2.4 Workplace as accommodation for organization**

The office building is a type of architecture designed with the purpose of providing workspaces and work places for organizations and individuals to produce capital. Well-designed offices play a crucial role in achieving business success. Good office spaces accelerate the achievement of commercial objectives. The changing relationship between design and organizational structure has been clearly described in former research and designs. Office design can be seen as an instrument of change management in potential. Reconsidering the use of human resources, reinventing the way of using information and technology, and redesigning the work environment must be included in management change process. It must be recognized that how office buildings are managed and obtained is as significant as the determination of work environment quality.

Vischer (2008) claimed that space and spatial decisions transmit and mediate the socio-cultural principles affecting human behavior and relationships. She considered space as a communicator of organizational values and culture. Space can be used as organizational resource, tool for work and a mediator between people and the organization they work for.

### **2.4.1 Symbolism**

Sundstrom, in his book *Work places* (1986), specified that individual workplace represents a symbolic medium for the expression of the worker's self-identity<sup>1</sup>, the individual's status in the hierarchy of the organization, and the effects on satisfaction and interpersonal relations.

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<sup>1</sup> Self-identity means an individual's own vision of his or her lasting characteristics and habits, particularly those that differentiate that person from other people (Sundstrom, 1986, p.217).

Self-expression in a workplace includes two aspects. One aspect is that a workplace is assigned to a specific individual and recognized by others as that person's workstation; the other aspect is that the occupants are more or less free to decorate, modify or rearrange the space depending on their personal preferences and reflecting their individual identity (Sundstrom, 1986). In addition to Sundstrom's expression, Vischer (2010) declared that space has a powerful symbolic function in a work environment. For instance, private offices, workstations and work desks are powerful symbols of individual and organizations' responsibilities, expectations, rights and commitment. Having or lacking partitions in individual workplace, the height of partitions, and having or lacking window with outdoor view are critical signs of social status in an organization (Vischer, 2010). However, the symbolism of an individual office tends to fade in current workplace design because project-based and group-oriented work is becoming common. Therefore, more open and flat spaces are needed.

Sundstrom (1986) showed that physical work environment accommodates self-expression. He further argued that the freedom to personalize the work environment could convey the uniqueness of each employee, and demonstrate that individuality is appreciated by the organization. Nevertheless, personalization presents not only the individual's self-identity, but also the amount of freedom and control permitted to the individual by the organization to exert over their workplace. It is possible to convey messages about the occupant of the workplace to coworkers and to visitors through workspace personalization. For instance, the occupant's tastes, preferences, attitudes, opinions, history, hobbies and personality, as well as requirements of psychological distance can be displayed.

BOSTI Associates found that employees who have more space to personalize in workplace report greater satisfaction with the physical work environment. However, those who have less opportunity to display in workplace report lower satisfaction with their physical work environment (Sundstrom, 1986). A survey (Wells, 2000) of 338 office workers at 20 companies revealed that personalization directly affects workers' satisfaction with their physical work environment, job satisfaction, and the company's personalization policy associates with organizational well-being.

#### **2.4.2 Collaboration**

Collaboration is a process of two or more than two individuals or organizations working together to reach the identical joint objective. Accordingly, collaborative work environment requires space, furniture and technological devices to support both individual concentration and group interaction.

Understanding both social and cognitive processes are useful to find the proper methods for supporting individual and collaborative work. The Productivity Protocol Working Group at

Carnegie Mellon University has divided collaboration into four different types: situational awareness, knowledge transfer, coordinated work, ideation and creative development (Hua, 2007).

Heerwagen *et al.* (2004) explained that awareness at workplace refers to knowing about what is happening in the surroundings and the meaning of the event or action, which is based on informal communication in workplace. The benefit of this kind of casual information flow is to improve coordination and information sharing, to increase observational and tacit learning, to provide the workers with the possibility and ability to find the information on current problems (Heerwagen *et al.*, 2004).

Knowledge transfer is considered as a formal type of collaboration. It is a complex process that includes both formal types of information transfer and brief interactions (Hua, 2007) (i.e. people ask questions, check facts, set up meetings, and joke with colleagues during the work day). Effective knowledge transfer guarantees productivity and the quality of work outcomes. Another benefit is that the improved task and group awareness in organizations aid in information flow, inspiration for new ideas, development of working relationships, and promotion of internal learning.

Hua (2007) described coordinated work as a common type of collaboration for large-scale tasks or multi-disciplinary understanding and complex problems solving. She also claimed that ideation and creative collaboration gathers the most intensive intellectual expertise inputs from multi-disciplinary team members.

### Workplace for collaboration

Tom Peter, a management consultant, who boosted a new workspace model in *Liberation Management* (1992), pointed out that physical space might be the most ignored and most powerful tool for provoking culture change, innovation and improving internal learning process within an organization. He indicated that space is the most effective way to develop dense and local learning networks that facilitate innovation.

Davis *et al.* (2010) and Duffy (2000) clearly demonstrated that architects have noted an obvious shift in terms of the way that knowledge workers spend their time, what kind of task they engage in, and the place where they choose to work. “Gillen stated, ‘Work environments are in a state of transition from something familiar and predictable to something not yet defined, multi-locational, virtual and physical’ (2006:62).” (Davis *et al.*, 2010). Following the change, organizations keep increasing their investment into innovative workspaces, upgrading open-plan offices to support more flexible, group-oriented, nomadic, remote working styles (Davis, Leach & Clegg, 2011).

Herman Miller Inc. (2008) conducted a series of workshops where they analyzed over one

thousand responses from managers, architects and design partners. They found that a physical space that provides connections to others and promotes communication in formal and informal ways was considered as an ideal work environment. In order to achieve connection and communication at a workplace, 'private-to-open spectrum' was invented to replace the open workplace. Private-to-open spectrum was described as "At one end are completely enclosed and walled offices; midway are systems furniture with standing-height panels and desk systems with seated-height panels; whereas at the far end of the spectrum there is a totally open area without any type of partitions to divide space." (Herman Miller Inc., 2008). Furthermore, Franklin Becker (2007) declared that space-functional inconvenience could create more chance of encounters, which will promote higher information learning in an organization. He explained that walking a slightly longer and circuitous route is not a waste of time since a longer trip could create the chance of encounters with people outside one's own group or department (Becker, 2007). Additionally, he suggested that the more interactions people have within or beyond their own group, the more corporate environment and the stronger sense of identity and belonging within the organization can be perceived (Becker *et al.* 2003).

Having visual and aural accessibility is considered as key environment contributors to workplace awareness (Gutwin & Greenberg, 2001). Good visual access includes having good visual access to surroundings, having visible displays of information, and having a possible group work surface that shows progress toward project targets. People can overhear others' conversations at a workplace, which allows them to assess whether somebody needs help. Overhearing conversation might be the most valuable when people work on the same or on similar projects or when the work is highly interdependent. Visual and aural accesses within workplace features are the presence or absence of opaque or transparent doors, walls, windows, workstation panels, mirrors, the size of the space and the physical proximity between the employees (Archea, 1977).

### **2.4.3 Innovation**

Innovation becomes to the core driver for a company's growth, performance and valuation. Successful workplace design is significant not only for improving the speed and outcomes of innovation efforts, but also for removing the barriers and supporting the knowledge workers' performance.

The U.S. General Services Administration (GSA) (2006) addressed seven characteristics of innovative workplaces: spatial equity, healthfulness, flexibility, comfort, connectivity, reliability and sense of place.

GSA (2006) identified a well-designed innovative workplace should meet user's function requirements, and provide occupants to access natural light, outdoor views, and space to talk



privately. Moreover, an innovative workplace provides a clean, healthy, comfortable and flexible work environment with good air quality, proper lighting and good acoustic conditions. A well-designed innovative workplace allows occupants control over the temperature, lighting, ventilation, acoustic level, and gives them the option to reconfigure the furniture and infrastructure to meet their work needs and to build personal and group satisfaction.

A survey by Steelcase WorkSpace Futures (2012) included more than 200 corporate real estate practitioners who investigated how the design and use of work settings can strengthen a company's posture for innovation. The survey results indicated that an individual work area cannot support innovation easily, and a traditional conference room does not either. Their research also provided some principles for designing workplace for innovation activities. They recommended making spaces flexible, inspiring, and collaborative; paying attention to making sure that the space could be a hard-working tool, and reflect the culture and the brand of the organization. They also stressed on the importance of making a space social (Steelcase WorkSpace Futures, 2012).

Making space flexible needs to be reconfigurable to support switches between distinct work styles, dynamic information flows and tools that are used temporarily. These requirements can be followed in architectural design by the use of semi-permanent walls or movable partitions; by creating flexible hubs for different sizes of work groups; by enabling user configurability with mobile furniture; or by offering enclosed spaces for audio and video meetings to protect privacy.

Creating inspiring space is crucial for knowledge work since generating something new is fundamental to knowledge work, and inspiration is particularly significant for organizational innovation. Stimulating space can provoke creative thinking. In physical space, it is important to provide natural experiences for knowledge workers. For instance, the provision of daylight, natural outdoor views, natural elements and materials throughout the space; the provision of casual, informal and comfortable settings; and the careful selection of interior colors according to their ability to excite or quiet.

Space available for collaboration must be convenient to use by innovative work groups sharing a mind and information. In order to make the space collaborative, it is important to locate individual work spots around group spaces in a way that maximizes visibility; to reserve a group discussion area for informal information flow and brainstorming; to provide vertical information display surfaces to help tracking the working process and target the final goal of the work group.

The physical workplace design can reflect an organization's identity and culture, and provide an encouraging context and meaning for innovators. Having space to display products and other collective achievements could inspire pride and induce a risk-taking spirit. The

availability of personalization for groups can reinforces the ownership feeling and identification within an organization. Design of open and relaxation areas for casual collaboration and informal conversations can build trust and help form social contacts, which are crucial components of successful innovation (Steelcase WorkSpace Futures, 2012).

## **2.5 Summary**

This chapter gives an overview of workplace related parameters that have been studied in previous research from several aspects, including workplace spatial elements, workplace design in relation to the human muscular system, psychological issues and the organizational perspective. It stresses on the understanding of the importance of workplace design in occupant well-being and for the organization.

However, the question is still applicable – which formation is the best – open-plan, cellular or combined? The debate on workplace layout has lasted for several decades and will remain valid also in future workplace design. There are other factors that have been frequently connected to workplace design, such as workplace density, the level of enclosure, the existence of a window and access to outdoor view, as well as the quality of outdoor view. These factors are directly linked to office workers' amenity. Although lower workplace density is desirable, when companies face cost pressure, increasing workplace density is likely to be the first option to turn to. The level of enclosure depends on the number and the height of the partitions. High level of physical barriers is associated with a high level of psychological privacy at the workplace. Having a window, experiencing daylight and having visual access to the outdoor view are helpful in decreasing the level of stress, which is considered to be one of the most common mental health problems in a work environment.

The architectural workplace does not only accommodate individuals, but also organizations. The symbolic function of a physical space can help to express the culture, values and spirit of an organization, also interprets the social status and organizational arrangement. Nowadays, the nature of work tends to be more collaborative, creative and innovative. Following this trend, workplace design has shifted to satisfy project-based work requirements to support collaboration and innovation. Therefore, physical workplace works as an effective instrument for organizational work and management.

## **Chapter 3**

### **Proposed Study**

#### **3.1 Research conceptual model**

##### **3.1.1 Precedent conceptual framework of architectural workplace in relation to individual and organization**

Workplace design has been developed and changed over time due to changes in the society's various trends and architects' ambition (Fischer, 1997). Organization and management theorists have had a great impact on workplace design. Taylor's theory of 'scientific management' with a strict hierarchy and clear control over employees was considered to be the most influential theory (Duffy, 1999). However, it was not trusted and did not last long.

Workplace was no longer considered to be a simple exterior framework, but was seen as a resource in terms of its inherent potential to make any social system function (Fischer, 1997; Moos, 1973; Perin, 1970; Thiel, 1997), an instrument to support employees' work performance and task. In applying this approach to work environment assessment, investigators study the links between workplace design and organizational work. They try to reveal the ways in which space can be considered to be an organizational resource (Vischer, 2008; Fischer, 1983; Fischer & Vischer, 1998; Kampschroer & Heerwagen, 2005; Seiler, 1984). Fischer (1997) introduced four major orientations for reference models that emphasize a specific spatial value as being a resource. These orientations are: architectural functionalism, workspace ergonomics, environmental competence and social intervention. Architectural functionalism attempts to

establish the best relation between environmental functions and organizational requirements. Workspace ergonomics is considered associated with workstations to facilitate the adaptation of new equipment with novel forms of work. Environmental competence concerns environmental design as an individual capacity to interact with and adjust the environment according to an individual's needs. Social intervention refers to the architectural space design as a process of change in the organization.

Architectural functionalism can be interpreted in two ways: architectural determinism or functional principles of architectural conception (Fischer, 1997). The notion of 'architectural determinism' is first expressed in Sundstrom's (1986) work. It refers to the physical factors that significantly influence the nature and frequency of interactions in an organization. The physical factors can be proximity of workspaces, accessibility, and availability of meeting areas. Similarly, Goodrich (1979) indicated that building design is an important variable that affects interpersonal communication, the nature of social interaction, the frequency and quality of these interactions, the perception of privacy, work activities, and employees' satisfaction in an organization. In general, architectural determinism believes that an architectural workplace has an effect on job behavior and social relations in an organization with material layout-imposed constraints. From this respect, the workplace is considered as a significant element in organizational strategy to achieve and reflect its goals through design, spatial elements and constraints. Moleski and Lang (1982) explained that an organization can be represented by a system of activity sites with the integration of a variety of networks. According to Homans (1950), activity in job context can bring individuals to interact and develop common feelings like values and attitudes. Interaction between individuals can provoke feelings, encourage collaboration and consequently lead to problem solution.

The functional principles of architectural conception are mainly concerned either with exterior architectural design or interior design. Exterior design refers to the building envelope, which is seen as an image of the organization. Architecture can help to enhance the identity of an organization, promote its excellence and raise the value of its products and activities through façade design. Interior design attempts to make a workplace pleasant, increase performance, improve health conditions, provide a sense of security, and reinforce the sense of belonging and being attached to an organization.

Fischer (1997) explained that environmental competence concerns space from an individual's perspective by providing an individual the capability to recognize, intervene and adapt to an environment with having control over the space (Steele, 1973). This includes an assumption that every individual has the possibility to change their environment, and find out the right spatial elements that increase their positive feelings at work. More specifically, Jutras and Cllen (1983) described environmental competence in a way whereby modifying an

environmental aspects is helpful to generate a harmonious relation between individuals and environment. Lauterman (1976) introduced environmental competence as a dynamic interactive system related to various behavior intentions. In Lauterman's interpretation, an individual is part of the environment rather than an executive with the power to adjust the environment's factors to enhance their own feeling of well-being.

In order to implement this framework, the qualitative potential for a space evaluation must first be defined and selected; for example, shelter/security, social contact, symbolic identification, instrumentality, pleasure and personal growth. After selecting specific spatial features, the next move would be to develop a series of questions linked to spatial elements that help to investigate whether the selected element facilitates, conflicts with or conceals its own environmental function in space. This evaluation can be used for analyzing all the physical elements that convey the effects and meanings through architectural design in organizations. During this process, individuals are considered as primary information resources when it comes to learning of their awareness of needs, selection of elements, planning action, interacting with the physical workplace, and the evaluation of the obtained modification (Fischer, 1997).

### **3.1.2 Personal control**

Evans and McCoy (1998) defined control as mastery or the ability to either alter the physical environment or regulate exposure to one's surroundings. Wang (2009) separated privacy from control according to Evans & McCoy's definition of control to make them independent in her daylighting research. She argued that privacy focuses more on visual exposure, whereas control focuses more on visual access. Fisher (1990) defined control in a similar way as Evan and McCoy. He explained that individuals with control can act to change or reverse situations that are disliked. Allen and Greenberger expressed control in more particular way stating "an individual can experience an increasing perception of control by alerting, modifying or transforming it in some manner in the built environment" (Allen & Greenberger, 1980:86).

Psychologists believed that providing personal control to an individual is necessary for well-being (Averill, 1973; Burger, 1989). In support of this idea, empirical studies addressed that a high level of control at work is positively associated with job satisfaction, work performance and human psychological well-being (Lee & Brand, 2005). Positive psychological effects are demonstrated also when employees are informed of how or trained to make use of the control available (Vischer, 2008; Newsham, Veitch, Arsenault & Duval, 2004). Vischer suggested that environmental control influences employees on at least two levels: instrument control and empowerment (Vischer, 2005). She argued that instrument control or mechanic control can be achieved by accessing ambient environmental conditions, like adjustable

furniture, lights that can be switched on and off, and doors that can be opened or closed. From the level of empowerment, it increases the chances that employees involved in workspace decision-making processes. Psychological control by means of user participation in the design process can positively impact people's feelings and responses to their workspace (Vischer, 2008).

A perception of personal control can temperate the relationship between the built environment and the occupants' response to the environment, which means having control can affect the environment through one's inherent tendency (Lee & Brand, 2005; Evans, Johansson, & Carrere, 1994). For instance, Frontczak and Wargocki (2011) found that a controllable environment is helpful in enhancing people's thermal, visual and acoustic satisfaction. Moreover, Morrow *et al* (1998) have revealed that occupants in an office have positive feelings when both manual and automatic control over the office lighting system are in place as long as these controls do not disturb their work. Similarly, Gatchel (1980) revealed that the residents in a nursing house experience a sense of personal control could ease some negative responses to the environment, and therefore lead to better adjustment in the new surroundings. However, contrary to all that, some research findings did not support that providing control for an individual could benefit satisfaction in practical terms. Veitch and Gifford (1996) found that people who have access to control over a lighting system have weaker performance than those who do not have that accessibility.

Numerous studies have revealed that control over the building systems (heating and lighting system) and facilities can moderate the relationship between the occupants and the physical environment, but little attention has been paid to personal control over the physical environment. Having personal control over the physical environment could ease the negative influence of environmental stimuli, like distractions on job satisfaction and performance in workplaces (Lee & Brand, 2010). Another study by Lee and Brand (2005) covered the topic of personal control over the workplace on the perception of the work environment and work outcomes. They measured control through the availability to determine the appearance of work area, personalizing, adjusting or reorganizing, work environment variety, and available space for prompting meetings. Their aim was to investigate the relationship between control and job satisfaction, satisfaction with the environment, and group cohesiveness. The results indicated that control positively related to the three outcomes addressed above. An earlier notable study (MacLaney & Hurrell, 1988) on control over the physical environment measured by work control covered several dimensions: task control, decision control, resource control and control over the physical environment. This research also demonstrated that having personal control positively affect job satisfaction. Additionally, Huang, Roberston and Chang (2004) measured personal control through adjustability and layout flexibility.

In the physical work environment, personal control can be distinguished to be objective or subjective (Lee & Brand, 2005). Lee and Brand (2005) explained that control at the objective level refers to the capability to modify the conditions of the physical environment; whereas control at the subjective level interprets the effects and outcomes from applying different control behaviors. They also claimed that providing occupants with the availability to adjust or change the features of their physical work environment, which influences personal control, is helpful in accomplishing some workplace design intentions. The concept of personal control in this research is developed on the basis of Lee and Brand's explanation of control. It refers to the knowledge worker's perceived availability to access and modify the physical workplace to meet their work needs.

### **3.1.3 Sense of belonging**

Anant (1966) defined belonging as "sense of personal involvement in a social system so that persons feel themselves to be an indispensable and integral part of the system". Anant focused on an affective and evaluative, rather than descriptive or perspective of belonging. Based on Anant's definition of belonging, the Hagerty group (Hagerty, *et al.*, 1992) defined belonging as "the experience of personal involvement in a system or environment so that persons feel themselves to be an integral part of that system or environment". A system can be a relationship or an organization, and an environment can be either natural or cultural. Belonging has also been defined as "being a member of a group or fitting into a group naturally" in American Heritage® Dictionary (Jones, 2009).

Hagerty *et al.* argued that sociological belonging implies membership in groups or social networks in general. Sociological belonging can be observed and explained through human behavior. From a psychological perspective, belonging is an internal affective or evaluative perception or feeling, which could be best described as sense of belonging. It is a person's experiences and perceptions of being needed, valued and respect by others, and fitting in with other people, into a group or an organization (Hagerty et al., 1992).

The need for belonging can contribute to explaining a variety of human behaviors, cognitive or motivational processes and emotions. On the other hand, many negative behaviors, psychological and social consequences, including mental disease, criminal tendencies and social isolation, can be associated with a lack of the sense of belonging. It has been identified that most emotional breakdowns are closely connected with a need for belonging, being needed, valued and respected (Hagerty et al., 1992; Maslow, 1968; Dasberg, 1976).

In 1954, Maslow proposed a well-known theory of human motivation. In his theory, he created a hierarchy of five levels of needs that begin with physiological needs as the most primitive and fundamental needs for air, food, drink, warmth, sex etc.; followed by safety needs

for both physical and psychological safety, such as security, physical protection, stability etc.; the next is the need for belonging and love, which represent the social relation to others and are experienced as a sense of belonging; after that comes the level of esteem which includes the sense of being respected and valued, having high self-esteem, and high level of achievement, status, dominance etc.; finally the need for self-actualization that is a need for learning and improving one's capabilities, seeking personal growth and peak experience. Additional support for the importance of belonging was given by Corey (2001, p.112) who stated that, "Only when we have a sense of belonging we are able to act with courage in facing and dealing with our problems".

Sense of belonging has been widely studied by psychologists, sociologists, social psychologists, and pedagogic scholars, but not as much by architects. Winter-Colins and McDaniel (2000) proposed an investigation to study the relationships between the sense of belonging and job satisfaction among new graduate nurses. The results of their study showed that the sense of belonging is significantly and positively related to overall job satisfaction encompassing praise, interaction opportunities, control, coworkers, and scheduling in the work environment. Other studies have found that the sense of belonging can improve subordinate satisfaction in an organization (Dobbins & Zaccaro, 1986), partially mediates the impacts on university students' grade point average (Shook & Clay, 2012), improves students' physical health (Hale et al. 2005), or has greater benefits in motivation and interpersonal behavior in a classroom settings (Edwards & Mullis, 2001). Researchers' work on virtual community (VC) demonstrated that when VC members perceive a stronger sense of belonging, they are more likely to internalize the social norms of a VC into their thoughts and take other members' opinions into serious consideration; they are also more willing to participate in the VC activities, for instance, to get knowledge from others and share their own (Zhao *et al.*, 2012). A recent research investigated the associations between employees' sense of belonging and their perceptions of workplace physical attributes at a corporate campus, or an office space. They found that the relevance of the corporate campus, perception of the personal workspace, familiarity of the subject company and its facilities are significantly related to the employees' sense of belonging (Jaitli & Hua, 2012).

In terms of work environment quality, sense of belonging is recognized as a better measure than satisfaction or effective work performance (Vischer, 2008), since it directly influences business operations and costs effectiveness. Several researches identified that the sense of belonging associates with employees' loyalty or commitment to their organization (Vischer, 2008; Fischer, 1983; Sundstrom & Sundstrom, 1989). Employees, who are emotionally bound to their organization, affective and committed, are considered having a strong sense of belonging and organizational identity. Having organizational identity encourages employees to



participate in the organization's activities, feeds their willingness to pursue the organization's object, and fuels their desire to remain in the organization (Vischer, 2008; Meyer & Allen, 1991; Mowday, Porter & Steers, 1982). "Employees need to feel a sense of belonging in order to find the meaning in their work and engage the power of their emotions. The more workers discover links between personal ideals, a meaningful intention or mission, and larger social values, the greater their commitment to their organization. They need to be able to connect their own identity to the organizations intrinsic identity in order to feel as a part of the collective. This provides them a mechanism for the expression of caring about the organization they belong to"<sup>2</sup>.

Sense of belonging has been revealed associated with sense of territoriality in organization (Vischer, 2006; Vischer, 2008; Sundstrom & Sundstrom, 1989). The sense of ownership or occupying a territory is strongly affected by the characteristics of an individual workplace. It is also influenced by participation in design decisions, and the feeling of empowerment regarding the environmental decision-making processes. Vischer (2008) pointed out that sense of territory is the primary component of psychological comfort at both the individual level and the group level. She further explained that the psychological value of human territory in the work environment is represented by the place for individual work and the individual's place within the organization. Sense of territory influences the office workers' interaction with the environment (Steele, 1986). Marking territory and constructing environmental control help to create personalization and appropriation of space from people's behavior schema (Vischer, 2008). Using novel technology and better virtual communication tools could also have an impact on the employees' perceptions towards their workplace (Cascio, 2000; Lai, Levas, Chou, Pinhanes & Viveros, 2002). Territory at workplace is affected by sense of privacy, social status and perception of control, which are not simply made up of solid walls and doors (Vischer, 2005).

Moreover, Fischer (1997) pointed out that sense of belonging relies on a certain number of physical environmental support factors, including the location of the workstation in the workplace as a whole, the size of individual workplace surroundings, the space function, the enclosure level of workplace, and the degree of flexibility.

### **3.1.4 Conceptual diagram**

The conceptual model (see Figure 3.1) of this research illustrates the view on the way in which workplace design constructs induce the sense of belonging, and how all of these factors in turn mediate a certain evaluation of organizational outcomes.

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<sup>2</sup> <http://www.theleadershiphub.com/blogs/importance-creating-sense-belonging-organizations>.

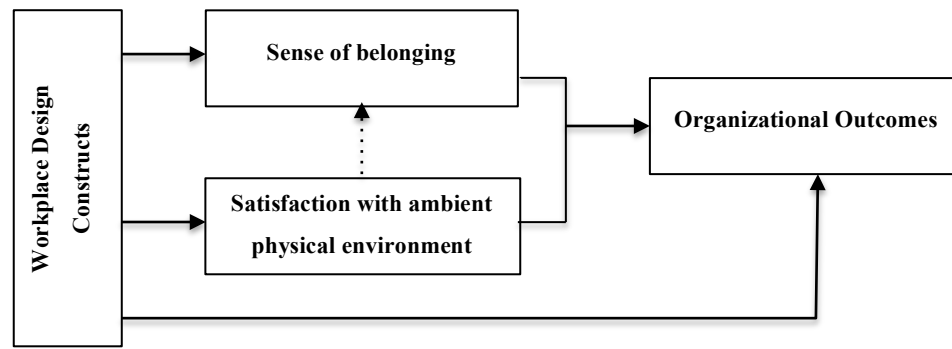


Figure 3.1 Proposed model of workplace design in relation of sense of belonging and organizational outcome

Based on the precedent theories and research results, a conceptual model has been developed. This conceptual model represents that the effects of workplace design on the organization and the employees can be studied from a human centered perspective. This approach is based on the assumption that physical work environment has a significant influence on an organization and its knowledge workers. Workplace design, its configuration and features affect the degree in which a company benefits from the acquired and useful abilities of its human capital (Vischer, 2010). The workplace mainly has three impacts on people in organizations: it is an organizational resource, connecting accommodation decisions with corporate business objectives (Fischer, 1997; Guillen, 1997); it is an instrument for work, providing support for the employee to fulfill their daily task (Leaman & Bordass, 2001); and as a mediator, mediating the impacts on intra-organizational relationships (Kampschroer & Heerwagen, 2005; Stephenson, 1998).

In this study, the physical workplace is studied in the narrow sense of term, focusing on design strategies related to personal control. Previous studies have found that personal control over the physical environment can moderate the physical environment conditions and the occupants' responses. Evans and McCoy (1998) indicated that various design constructs are salient to control. These constructs are physical constraints, flexibility, responsiveness, privacy, spatial syntax, defensible space, and certain symbolic components (Evans & McCoy, 1998). These concepts can be realized in different design strategies, for example in the amount of available space, visual exposure, structural depth, openness of the perimeter, brightness, extent of view, and moveable partitions, and semi fixed furniture (Evans & McCoy, 1979; Sommer, 1969). In this study the amount of available space, flexible use of space, functional distance, visual dominance, speech privacy and personalization are used for measuring personal control.

This research concentrates on workplace design constructs through organizational outcomes. To fully demonstrate the value of workplace design, a broader concept of

organizational outcome, comprising of commitment, work motivation, job satisfaction and individual work performance, is used. 'Commitment' refers to the employees' willingness to remain in their current organization. 'Work motivation' refers to the drives of a person's choice to work hard or not, perform better or worse, and achieve goals or not. The meaning of work motivation here is similar to Locke and Latham's concept of motivation whereby they describe motivation as the reason that pushes or pulls people to behave in certain ways. 'Job satisfaction' refers to whether the person would recommend their current job to others, choose to work in the current company again and whether they are doing a satisfactory job. 'Work performance' refers to the individual's work performance.

Organizational outcome alone is not an adequate reflection of people's evaluation to a stimulus of the design construct. People do not always obtain a correct understanding of their own work conditions, outcomes or organizational status directly through their perception. Their evaluation of their own perception can come in the form of feeling or mood change. These mental processes can differentiate people's evaluation in a work environment. Therefore, this study examines workplace design strategies on two levels: organizational outcomes and sense of belonging. Sense of belonging is the primary component of an occupant's psychological comfort in work environment. It has been revealed associated with commitment, satisfaction, motivation and performance in organizations. Empirical studies show that increasing the level of perceived personal control over physical work environment is helpful to improve people's sense of belonging in an organization. Sense of belonging directly influences not only the employees' interaction with their environment, but also the business success and cost effectiveness.

Huang *et al.* (2004) found that high level of perceived control in a workplace can lead to higher level of environmental satisfaction in terms of occupants' ability to use the workplace and its adjustable features effectively. A related work by Lee and Brand (2005) demonstrated that perceived high level of personal control over physical workplace is positively related to satisfaction with the physical work environment. Researchers have indicated that perceived satisfaction with physical work environment impacts attitude, job perception, job satisfaction (Sundstrom *et al.*, 1994; Zalesny, Farace, & Hawkins, 1985; Lee & Brand, 2005), organizational commitment (Carlopio, 1996), and positively affect occupants' rating of well-being (Larsen *et al.*, 1998).

### **3.2 Independent variables: workplace design elements**

Within this study workplace spatial elements are examined through the sense of belonging, satisfaction with ambient physical environment, and organizational outcomes. Proposed independent variables are developed based on the design constructs related to the personal control over physical environment. The previous chapters have discussed the significance of personal control over the physical environment and the corresponding architectural design strategies.

The proposed spatial features have been divided into two categories: one focuses on workstation design; another emphasizes on workplace floor plan layout design. The former contains the amount of available space, personalization, visual dominance and speech privacy; the later includes flexible use of space and functional distance. The aim of the category related to workstation design is to contribute to the determination of the size, enclosure type and level, location and orientation of the workstation. Spatial elements related to workplace configuration will contribute to optimize the number, type and location of meeting, conversation and collaborative workspaces, service areas, degree of flexibility, and the relationship between workstations, administrative areas and service areas.

### **3.3 Dependent variables**

In this section, the dependent variables proposed for measuring spatial characteristics related to workplace design are discussed. There are a total of three categories of dependent variables. The first is the sense of belonging, the second is the satisfaction with the ambient physical environment, and the last is the organizational outcome that contains four variables: commitment, work motivation, job satisfaction and individual work performance.

#### **3.3.1 Measurement of sense of belonging**

The present study explores if sense of belonging mediates the relationship between workplace design features and organizational outcomes, and which spatial feature has significant effects on employees' sense of belonging. The instrument for measuring sense of belonging has been selected and developed based on The Sense of Belonging Instrument (SOBI, by Hagerty & Patusky, 1995) to make it more appropriate for a work environment. These developed items for measuring sense of belonging in this research are written in negative. They aim to measure the subjects' sense of belonging in their organizations from the six flowing aspects of organization.

- I am just not sure if I fit in with my colleagues.
- I would describe myself as a misfit in most social situations.
- I would like to make a difference to people or things around me, but I don't feel that what I have to offer is valued.
- I don't feel that there is anyplace where I really fit in this organization.
- I am uncomfortable that my background and experiences are so different from those who are usually around me.
- I am not valued by or important to my boss.

### **3.3.2 Measurement of satisfaction with ambient physical environment**

Ambient physical environment includes lighting conditions, thermal and acoustic situations within the workplace, which provide general appropriate physical conditions for human comfort and healthy needs and support work or task performance. In this research satisfaction with ambient physical environment is measured in a direct way by asking survey participants to evaluate the ambient conditions of their architectural workplace environment.

### **3.3.3 Measurement of work motivation**

The correlation between spatial features and work motivation attract little attention in previous workplace research. This research investigates if spatial characteristics significantly and directly influence employees' work motivation.

Previous motivation researches have no agreement on a unique and universal definition of motivation. Using mechanical analogy, motivation can be described as the motive forces that get a machine to start and keep working. If a person is motivated to do something, he/she may try hard and long to 'do' it. Individuals' reports of what they are trying to do, how hard they try and how long they keep trying, can be used as an indicator of motivation. According to Latham's definition, motivation is made up of three components: direction (choice), effort (intensity) and persistence (duration). Direction refers to what a person is trying to do; effort shows how hard a person is trying; persistence means how long a person will keep trying (Arnold *et al*, 2010).

Maslow's hierarchy of needs is the best-known theory in early theories of motivation. Simon (1997) identified that the basic challenge for all organizations is to induce their workers to work toward the organizational goals. Work motivation plays a key role in the long-term success of an organization because creating meaningful work and keeping employees happy are at the core of fostering organization effectiveness (Preffer, 1998).

Workplace quality significantly impacts the level of employees' work motivation. How

well employees engage with their immediate workplace influences their work performance, and level of innovation and collaboration with others, to a great extent.

Based on Latham's definition of motivation, in this research work motivation is measured according to direction, effort, duration and self-actualization.

- I have a clear idea of future development steps of my department.
- I always enjoy working and performing my best.
- It always nice to come to work everyday.
- My work makes me feel self-fulfillment.

### **3.3.4 Measurement of commitment**

Multiple definitions of organizational commitment can be found in literature. The most broadly used definition of organizational commitment in relevant research was given by Porter, Steers, Mowday and Boulian in 1974. They defined organizational commitment as the strength of an individual's identification and involvement in a specific organization. They claimed it has three psychological characteristics: desire to remain in an organization, the willingness to exert considerable effort on the organization's behalf, and the belief in and acceptance of the organization's goals and values. A later definition of organizational commitment generally supported Porter et al.'s work, "Organizational commitment is a willingness to exert high levels of effort on behalf of the organization and a definite belief in, and acceptance of the values and goals of the organization" (Martin and Nicholls, 1987).

Commitment is considered to be the backbone of an organization. It is an essential precursor for high performance (Walton, 1985). The more commitment people have, the more effect they have on each other. Meanwhile, those who perceive high level of commitment are more productive, feel more positive and encouraged to achieve the organizational goals. On top of that, commitment can foster trust and caring between the members of the organization. Consequently, people who share commitment perform collaborative work in a great manner.

Commitment is particularly important in the era of knowledge. Knowledge has been acknowledged as an exclusive human process (Polanyi, 1958; Davenport & Prusak, 1998). It is a resource that is embodied in an individual or a collective, a routine or a process (Laszlo & Laszlo, 2002). The organizational knowledge embedded in an organization, which is interdependent on individual knowledge in transforming or creating individual knowledge to organizational knowledge. According to this, organizations need to build and sustain the knowledge workers' commitment. High turnover of knowledge workers means loss of tangible and intangible knowledge and potential competitive ability (Kinnaer & Sutherland, 2000).

Workplace is crucial in the process of building and sustaining employees' organizational commitment. Architecture design can create a place where to focus on the value for all the members within the organization whereby a more effective engagement with the organization can be achieved, and through which contributions to the individual and organizational identity can be made.

In this study, organizational commitment is measured in a direct way by asking survey participants to evaluate their degree of commitment in their current organization. The measured statement of commitment is 'I have strong commitment to my department'.

### **3.3.5 Measurement of job satisfaction**

Job satisfaction has been broadly used for measuring work environment quality. Previous research that investigates the influence of architecture design on job satisfaction found that office type affects occupants' self-reported job satisfaction (Bodin Danielsson, 2010). People who work in enclosed cellular offices experience higher job satisfaction than others. Moreover, workplace spatial layout is confirmed as the dominant factor that influences employees' well-being and job satisfaction (Bodin Danielsson, 2010; Wineman & Adhya, 2007). High level of availability to control over the physical environment also approves significantly relate to job satisfaction (Lee & Brand, 2005; Salama & Courtney, 2013).

In this study, job satisfaction is one of the aspects of organizational outcomes to measure if workplace spatial characteristics have important effects on an organization's outcome or not, and further identify which spatial elements affect job satisfaction in a significant way. The measurement of job satisfaction is adapted from standard job satisfaction (Lee & Brand, 2005; Anderson & West, 1998). Job satisfaction is estimated from three aspects: whether the person would recommend their job to a friend, whether they would choose to work in their current firm again, and how satisfied they are with their current job.

### **3.3.6 Measurement of work performance**

Work performance generally refers to whether a person performs their job well. It is an extremely important criterion that associates with organizational outcome and success. Empirical study demonstrates that there is a strong association between workstation layout, environmental control and individual work performance (Robertson & Huang, 2006).

According to Campbell (1990), performance is a behavior. It can be measured either through direct observation or through subjective evaluation. In this study, work performance mainly focuses on the individual perceived work performance. In order to measure knowledge workers' perceived individual work performance, an item has been adapted from the literature

(Hua, 2007). The survey participants are asked to respond ‘I always accomplish my individual work efficiently’.

### 3.4 Hypotheses

The goal of this thesis is to explore the impacts of workplace design characteristics on knowledge workers’ sense of belonging and their organizational outcomes. Further, identifying the key features of workplaces spatial elements that support knowledge workers’ sense of belonging and their commitment, work motivation, job satisfaction and work performance; and develop a theoretical model of workplace design impact on sense of belonging and organization effectiveness.

Six hypotheses were advanced concerning workplace spatial features, sense of belonging and organizational outcomes (Figure 3.2).

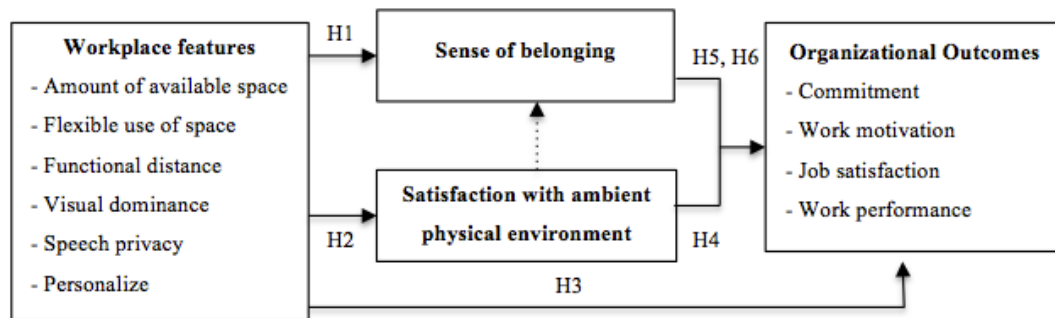


Figure 3.2 Research hypotheses

- **Hypothesis 1:** The workplace features significantly influence knowledge worker’s sense of belonging in current organization;
- **Hypothesis 2:** The workplace features significantly influence satisfaction with ambient physical work environment;
- **Hypothesis 3:** The workplace features significantly influence organizational outcomes;
- **Hypothesis 4:** Satisfaction with ambient physical work environment significantly affect organizational outcomes;
- **Hypothesis 5:** Sense of belonging significantly relate to organizational outcomes;
- **Hypothesis 6:** Sense of belonging mediates the workplace features and organizational outcomes.



### **3.5 Summary**

The concept of personal control can be realized in architecture design strategies in different ways, for instance, providing certain amount of available space, visual exposure and flexible partitions etc. Having sense of belonging at workplace is affected by the access to personal control. This thesis proposed a research conceptual model of personal control related workplace design features in relation to knowledge workers' sense of belonging and organizational outcomes. It is aim to investigate how and which workplace design elements influence individuals' sense of belonging, ambient environment satisfaction, organization commitment, work motivation, job satisfaction and individual work performance. All of the design constructs are the independent variables in the conceptual model. The dependent variables are sense of belonging, ambient environmental satisfaction and the organizational outcomes. After explaining the every detail of proposed study model, hypotheses of workplace design characteristics have significant influence on sense of belonging and organizational outcomes come as following. This study also hypothesizes sense of belonging plays a mediating role between workplace design factors and organizational outcomes.

## Chapter 4

### The Field Survey

#### 4.1 Research setting

In order to collect the data for testing the hypotheses and examining the research model that presented in precede chapter, a field survey was designed and carried out in the city of Dresden. The cellular office can fulfill knowledge workers' needs of concentration. Also the proposed spatial features within the research model can be easily and clearly defined in cellular office. Therefore, the field survey was conducted in cellular offices with one to six employees per room (see Figure 4.1).



Figure 4.1 Selected offices from field survey

Sixteen organizations (list below) participated in this survey, including local and international firms, research institutions, administrations and public sectors in Dresden, Germany. This study lasted for 4 months, from April 2013 to middle of July 2013. A set of questionnaire about 'Spatial and Work Experience' was administered in each of the participated organizations.

The sixteen organizations are:

1. Institut für Sächsische Geschichte und Volkskunde (ISGV)
2. Sächsische Landesbibliothek – Staats- und Universitätsbibliothek Dresden (SLUB)
3. Max Planck Institute for the Physics of Complex Systems
4. Schüßler-Plan Dresden
5. Faculty of computer science of TU Dresden
6. DB ProjektBau GmbH Regionalbereich Südost Standort Dresden
7. FORMAXX AG Dresden
8. CINEDAVIS GmbH
9. Hilton Dresden Hotel
10. Leibniz Institute of Polymer Research Dresden
11. Institut für Holztechnologie Dresden gemeinnützige GmbH
12. LINGNER STADT
13. Schweitzer Fachinformationen
14. CiTRiX
15. IAS-Gruppe Dresden
16. Landeshauptstadt Dresden Umweltamt

## **4.2 Subjects**

500 copies of questionnaire were distributed in these sixteen organizations, 336 participants responded the questionnaire, 240 had adequate data on all of the relevant variables and thus included in the data analysis. The respondent rate was 67.2% and valid rate was 71.4%. Among the 240 usable samples, 102 respondents (42.5%) were female and 138 respondents (57.5%) were male, see Table 4.1; age from 20 years old to over 60 years old, see Table 4.2; 33 (13.8%) worked in executive/managerial jobs, 78 (32.5%) worked in professional/technical jobs, 34 (14.2%) worked in creative/inventive jobs, 61 (25.4%) worked in research & development jobs, 27 (11.3%) worked in communication and 7 (2.9%) in other jobs, see Table 4.3. 23 (9.5%) participants worked alone in an office, 51 (21.25%) shared office with one

colleague, 76 (31.7%) shared office with two colleagues, 58 (24.2%) shared office with three colleagues, 32 (13.3%) shared office with more than three colleagues.

Table 4.1 Gender

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Female	102	42.5	42.5	42.5
Valid Male	138	57.5	57.5	100.0
Total	240	100.0	100.0	

Table 4.2 Age

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
20 to 29 years old	90	37.5	37.5	37.5
30 to 39 years old	78	32.5	32.5	70.0
Valid 40 to 49 years old	32	13.3	13.3	83.3
50 to 59 years old	33	13.8	13.8	97.1
60 years old or over	7	2.9	2.9	100.0
Total	240	100.0	100.0	

Table 4.3 Work type

	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Executive/Managerial	33	13.8	13.8	13.8
Professional/Technical	78	32.5	32.5	46.3
Creative/Inventive	34	14.2	14.2	60.4
Valid Research & Development	61	25.4	25.4	85.8
Communication	27	11.3	11.3	97.1
Other	7	2.9	2.9	100.0
Total	240	100.0	100.0	

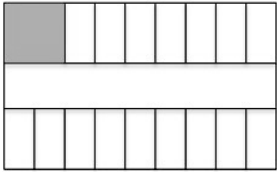
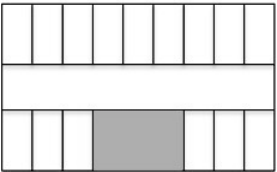
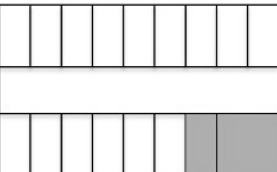
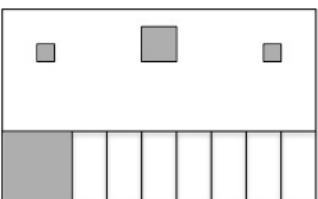
### 4.3 Floor plans

Subjects from sixteen organizations contributed to present research. The sixteen organizations locate in different buildings and areas of Dresden. The floor plan of these buildings were recorded and studied. The floor plans were categorized based on the meeting space layout and service spaces (kitchen and copy/print space) layout. The type of meeting space layout, kitchen layout and copy/print space layout were summarized.

### Meeting space

According to the location of meeting rooms or spaces on floor plans, meeting space layout can be categorized into 4 types, see Table 4.4.

Table 4.4 Type of meeting space layout

	NO of respondents	Diagram	Description
M <sub>1</sub>	N=73		One meeting room on the end of floor
M <sub>2</sub>	N=27		A large meeting room on the central of the floor
M <sub>3</sub>	N=92		Various size of meeting rooms on the floor
M <sub>4</sub>	N=48		One meeting room on the end of floor and several meeting spots distributed on the open floor area

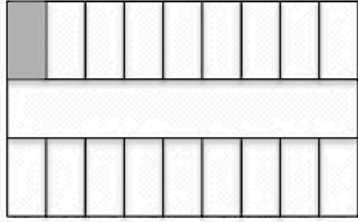
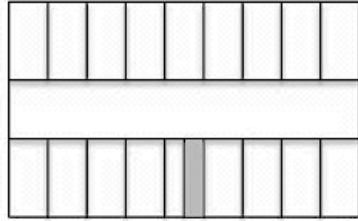
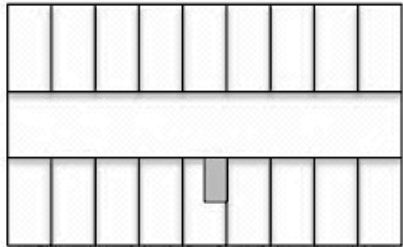
### Kitchen space layout

Kitchen layouts were studied based on the relationship between location, outdoor view and daylight. They were summarized into three categories and presented in table 4.5.

### Copy/print space layout

Copy/print areas on the floor were recorded and analyzed. There were three major types of layouts for copy/print space in the studied floor plans (see Table 4.6). Subjects who use private printers were not included in this table.

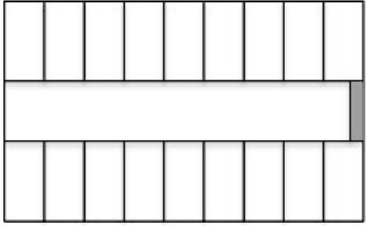
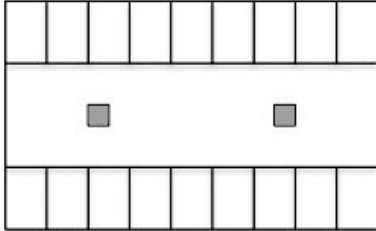
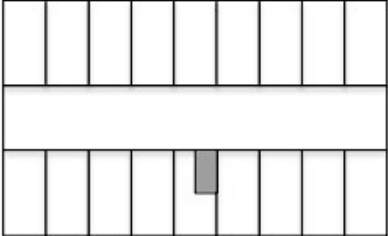
Table 4.5 Type of kitchen layout

	NO of respondents	Diagram	Description
K <sub>1</sub>	N=91		On the end of floor with daylight and broad view
K <sub>2</sub>	N=79		On the central of floor with natural light and outdoor view
K <sub>3</sub>	N=70		On the central of the floor without natural light and outdoor view

#### 4.4 Procedure

The data were collected in a variety of ways, including physically distribution of hard copies and via email containing the survey form in Word Document. The questionnaire was edited in both English (see Appendix A) and German (see Appendix B). 97% of the survey was conducted in the German version. All of the participants were guaranteed confidentiality of their responses. Also they were ensured their responses only used for scientific research purpose in an aggregated way.

Table 4.6 Type of copy/print space

	NO of respondents	Diagram	Description
C <sub>1</sub>	N=49		On the end of corridor
C <sub>2</sub>	N=34		Distributed on the corridor
C <sub>3</sub>	N= 87		On the central of floor without natural light and outdoor view

## 4.5 Survey instrument

The original questionnaire consisted of 7 parts using Likert-style scoring system with 4 options ranging from 1 (strongly disagree) to 4 (strongly agree). The first part of original questionnaire was ‘Workplace Experience’, the second part was ‘Work Motivation, the third part was ‘Job Satisfaction’, and the following parts were ‘Sense of Belonging’, ‘Commitment’, ‘Work Performance’ and ‘Demographic Information’.

The developed 32-items questionnaire (see Appendix B-1&2) was derived from the original 41-items questionnaire (see Appendix A-1&2) excluding the 5 items of demographic information. This process involved several stages. First of all, 6 items were adapted from The Sense of Belonging Instrument (SOBI), developed by Hagerty and Patuskay (1995), to measure office workers’ sense of belonging; 4 items were developed based on three components of motivation concerns: direction, effort and persistence (Arnold & Randall et al. 2010) to measure work motivation; 26 items were developed to measure workplace experience based on previous literature review and workplace spatial design options; job satisfaction (3 items) (Lee & Brand,

2005), commitment (1 item) and work performance (1 item) (Hua, 2007) were adapted from literature survey. Next, a sample of 179 knowledge workers from 9 organizations responded the original 41-items questionnaire. 154 of them had adequate data on the entire relevant variable for prior data analysis. Items reduction was processed to examine the items of original questionnaire. 32 items were retained from prior data analysis to study proposed constructs. Third, this complete set of 32-items questionnaire was then field-test with 157 office employees in 7 organizations. 86 valid sets of data were used for data analysis.

#### **4.5.1 Spatial experience in workplace**

The first part of the questionnaire (Part I) aimed to access knowledge workers' spatial experience at their workplace. Participants were asked to indicate the extent that they agree on 4-points Likert-style scale, 1 (strongly disagree) 2 (disagree) 3 (agree) 4 (strongly agree), with 26 statements about workplace according to their experience. These statements contained 7 key spatial design concepts of control (Evan & McCoy, 1998): amount of available space (from item 1 to 3), flexibility of using space (from item 4 to 6), personalization (from item 7 to 9), visual access (from item 10 to 12), visual exposure (from item 13 to 17), speech exposure (from item 18 to 22) and functional distance (from item 23 to 25). Statement 26 was aim to measure the overall environment quality. Therefore, it was not included in the prior data analysis for testing the spatial design constructs.

The following were the statements of questionnaire part I – Workplace Experience.

1. I can keep my work within arm's reach.
2. There is sufficient storage space for my work in my workstation.
3. There is adequate space in my workstation to hold face-to-face meeting.
4. There are sufficient types of places for different conversation or meeting needs.
5. There is always a meeting room/space available when I need it.
6. I can always find a suitable place for certain type of conversation or collaborative work.
7. I can decide the appearance of my workplace.
8. I can personalize my workplace.
9. I can rearrange the furniture and computer to a suitable place in my workplace.
10. I can see both entire room and outdoor view from my workstation.
11. I can see entire room but I cannot see outdoor view from my workplace.
12. I can see outdoor view but I cannot see entire room from my workplace.
13. Everybody can see my computer screen at any time.
14. Others can see my workstation when they stand up.
15. People passing by can always see my work area and what I am doing.
16. Only my coworkers from my group can see my work area.



17. Nobody can see my computer screen except me.
18. I can hear my colleagues clearly when they are calling or talking to other people.
19. People can hear me when I speak on the phone or talk to others.
20. I have enough speech privacy in my workplace.
21. I can close the door or adjust the partition to keep the noise outside of my workplace.
22. I can contain the sound within my workstation when I speak on the phone or talk to others.
23. My workplace is close to the copier/printer area.
24. My workplace is close to the kitchen or coffee area.
25. My workplace is close to the supervisor's office.
26. I am satisfied with the ambient environmental conditions in my workspace.

Responses to the spatial experience (questionnaire Part I) were subjected to an exploratory factor analysis (EFA). The principal axis factor method was used to extract the factors. A scree test suggested seven factors with eigenvalue greater than 1, which were meaningful factors. These meaningful factors were retained for a promax (oblique) rotation. In interpreting the rotated pattern matrix, if the factor loading of an item is 0.40 or greater than 0.40 for a given factor, and less than 0.40 for other factors, this item is said to load on the given factor. Using these criteria, questionnaire items and corresponding factor loadings were presented in Table 4.7. The Pattern Matrix showed that there were three items load on factor 1 to factor 5 and factor 7 respectively. These six factors were latent factors. Factor 6 had only one variable load on it. This variable was retained as a manifest variable to measure factor 6.

Item 4 to item 6 extremely loaded on factor 1 which was subsequently label flexible use of space factor; item 18 to item 20 heavily loaded on factor 2 that was labeled the speech privacy factor; item 7 to item 9 loaded on factor 3 that can be labeled personalization factor; item 23 to item 25 loaded on factor 4 that was labeled functional distance factor; factor 5 had item 13 to item 15 loaded on it so that factor 5 was labeled visual privacy factor; there was only item 10 loaded on factor 6 that could be labeled visual dominance factor; Item 1 to 3 loaded on factor 7 that was labeled available of amount of space factor.

The original variables (11, 12, 16, 17, 21, 22) didn't load on any factor so that they were scratched out from the data analysis. And item 10 was remained as manifest variable to measure visual dominance factor. Item 21 and item 22 were designed to measure speech privacy. However, participants couldn't identify the differences between isolating the noise from outside and containing their own voice in the workplace. Consequently, these two variables failed to measure speech privacy at any condition in the prior study.

Table 4.7 Pattern matrix<sup>a</sup>

Variables	Factor						
	1	2	3	4	5	6	7
1							.644
2							.728
3							.414
4	.957						
5	.846						
6	.748						
7			.839				
8			.478				
9			.839				
10						.856	
13					.516		
14					.636		
15					.422		
18		.592					
19		.964					
20		.913					
23				.797			
24				.717			
25				.862			
<b>11</b>						<b>-.542</b>	
<b>12</b>						<b>-.752</b>	
<b>16</b>							
<b>17</b>					<b>-.787</b>		
<b>21</b>							
<b>22</b>							

a. Only the factor loading with absolute value  $\geq .40$  were presented.

Coefficient alpha was calculated to assess the scale reliability of the six sets of remaining variables from EFA respectively. It was found that visual privacy factor with coefficient alpha less than 0.70, which was dropped off. From EFA, item 13 to item 15 loaded on visual privacy factor, which were scratched out. Coefficient alpha reliability estimates were reported in Table 4.8.

Table 4.8 Descriptive parameters for architecture features

Variables	Mean	SD	Coefficient Alpha
1. Amount of available space	9.60	1.873	.700
2. Flexible use of space	9.13	2.180	.872
3. Personalize workplace	9.51	1.650	.751
<b>4. Visual privacy</b>	7.59	2.009	<b>.496</b>
5. Speech privacy	9.69	2.018	.856
6. Function distance	9.00	2.061	.833

From the prior data analysis of spatial experience responses, 17 items were retained from the original 26 items for the further field test. The results were summarized in Table 4.9.

Table 4.9 Retained items from prior data analysis

Factor	Questionnaire items
Amount of available space	1. I can keep my work within arm's reach. 2. There is adequate space in my workstation to hold face-to-face meeting. 3. There is sufficient storage space for my work in my workstation.
Flexible use of space	4. There are sufficient types of places for different conversation or meeting needs. 5. There is always a meeting room/space available when I need it. 6. I can always find a suitable place for certain type of conversation or collaborative work.
Personalize	7. I can decide the appearance of my workplace. 8. I can personalize my workplace. 9. I can rearrange the furniture and computer to a suitable place in my workplace.
Visual Dominance	10. I can see both entire room and outdoor view from my workstation.
Speech privacy	18. I can hear my colleagues clearly when they are calling or talking to other people. 19. People can hear me when I speak on the phone or talk to others. 20. I have enough speech privacy in my workplace.
Function distance	23. My workplace is close to the copier/printer area. 24. My workplace is close to the kitchen or coffee area. 25. My workplace is close to the supervisor's office.
Satisfaction with ambient environment	26. I am satisfied with the ambient environmental conditions in my workspace.

### 4.5.2 Work motivation

The second section of the questionnaire (Part II) was work motivation, which was designed to access office knowledge workers' work motivation. The variables that used to examine employees' work motivation were developed based on the three key components of motivation concerns. Arnold and Randall et al. (2010) addressed three significant factors of work motivation:

1 Direction: what a person is trying to do.

2 Effort: how hard a person is trying.

3 Persistence: how long a person continues trying.

The items for estimating work motivation were listed as followings:

- I have a clear idea of future development steps of my department.
- I always enjoy working and performing my best.
- It always nice to come to work everyday.
- My work makes me feel self-fulfillment.

The same method that was used for examining the developed variables to measure spatial design constructs was conducted to evaluate the responses of work motivation. Only one factor of work motivation was extracted with eigenvalue = 2.459. All of the variables loaded on this factor and their factor loadings were greater than 0.40. The scale reliability was assessed by calculating Cronbach's alpha. The reliability estimates was 0.777, which presented at a satisfactory high level. The proposed items addressed on the same issue of work motivation. The simple descriptive statistics of work motivation were presented in Table 4.10.

Table 4.10 Questionnaire items and corresponding factor loading from the factor matrix

Questionnaire item	Factor loading
I have a clear idea of future development steps of my department.	.486
I always enjoy working and performing my best.	.813
It always nice to come to work everyday	.729
My work makes me feel self-fulfillment.	.755

### 4.5.3 Job Satisfaction

Job satisfaction was a latent construct in this research. It was measured by three items. These items were adapted from previous literature study (Lee & Brand, 2005). All these three items loaded on a single factor of job satisfaction with eigenvalue = 2.284. The factor matrix

was showed in Table 4.11. Scale reliability test demonstrated the Cronbach's alpha at 0.841 and the items were highly correlated to each other.

Table 4.11 Factor matrix of job satisfaction

Description	Factor loading
recommend job to a friend	.995
choose to work in current organization again	.706
satisfied with current job	.715

#### 4.5.4 Sense of belonging

The fourth part of the questionnaire was intended to evaluate the office knowledge workers' sense of belonging. The questionnaire items of this part were developed from The Sense of Belonging Instrument (SOBI) developed by Hagerty and Patusky (1995). All of the six items were written in negative (listed below). The Likert-styling score from 1 (Strongly Disagree) to 4 (Strongly Agree). In terms of sense of belonging statements, meaning that score 4 would represent a low level of sense of belonging.

- I am just not sure if I fit in with my colleagues.
- I would describe myself as a misfit in most social situations.
- I would like to make a difference to people or things around me, but I don't feel that what I have to offer is valued.
- I don't feel that there is anyplace where I really fit in this organization.
- I am uncomfortable that my background and experiences are so different from those who are usually around me.
- I am not valued by or important to my boss.

Only one variable of sense of belonging factor was extracted from exploratory factor analysis with eigenvalue at 3.057. And all of the variables fairly loaded on this factor at a satisfactory level (see Table 4.12). Coefficient alpha was computed to test the internal reliability. It was 0.800, which means internal reliability evaluation indicated a high reliability or consistency of this set of survey items.

Table 4.12 Factor matrix of sense of belonging

Description	Factor loading
not sure if I fit in with colleagues	.684
misfit in most social situations.	.453
don't feel that what I have to offer is valued.	.720
don't feel fit in this organization.	.700
uncomfortable about the different background with colleagues	.618
not valued by or important to my boss	.658

#### 4.5.5 Commitment

The organizational commitment was measured by a single statement of 'I have strong commitment to my department'. Commitment was a manifest variable in present investigation. Likert score was employed to access the level of commitment, from 1 represents the lowest level of commitment to 4 shows the highest level of commitment.

#### 4.5.6 Work performance

Work performance assessment was listed at the six part of the questionnaire. It was measured by a single statement of 'I always accomplish my individual work efficiently.' Work performance was treated as a manifest variable in this research.

### 4.6 Summary

In order to examine the research hypotheses, a field survey was designed and administrated in 16 organizations in the city of Dresden for data collection. According to the research conceptual model, a set of questionnaire was designed to measure both independent and dependent variables. Exploratory factor analysis (EFA) was conducted to test and develop the survey instrument – questionnaire. During prior data analysis, the factor of visual privacy was dropped off, and all of the predictors of visual privacy were scratched out. Besides, items were designed for measuring speech privacy failed as well because of the participants couldn't identify the differences between these two statements. Finally, 32 items were retained from the original 41 items questionnaire excluding the 5 items of demographical information. Indicators for all of the proposed research constructs were measured at this stage.

## Chapter 5

### Data Analysis

#### 5.1 Correlation analysis

The correlation analysis was performed by using raw data with all of the variables that have been defined in Chapter 4. The Pearson correlation coefficient and the statistic level of significance ( $p$ ) were calculated.

Demographic items allowed the comparisons based on participants' gender, age and work type (Managerial, R&D, professional/technical communication or creative/inventive). Present research found:

- Men generally perceived higher level of satisfaction with ambient physical environment than women ( $p < 0.05$ );
- More female considered that they were less fit in the organization than male ( $p < 0.05$ ), and more female felt less valued to make difference in the organization than male ( $p < 0.05$ );
- Work type didn't influence subjects' sense of belonging, satisfaction with ambient physical environment;
- No surprisingly, the managers or executive officers were more motivated ( $p < 0.01$ ), performed better ( $p < 0.05$ ), and had higher level of speech privacy ( $p < 0.05$ ) than others.

Correlations between spatial elements demonstrated that the amount of available space for individual at work was significantly and positively associated with the flexible use of space and work area personalization:

- Those who work in bigger size of workstation had more possibility to design and arrange their working area ( $p < 0.01$ );
- Large size of individual workstation can meet the requirements of flexible use of space greatly ( $p < 0.01$ ).

People who have high level of visual dominance over the whole workplace and outdoor view declared:

- Having enough space for storage ( $p < 0.05$ );
- Being able to hold face to face meeting in their workstation ( $p < 0.01$ );
- Having sufficient type of places for conversation ( $p < 0.05$ ), and can easily find a meeting space as needed ( $p < 0.05$ ).

The results also indicated that the correlation between functional distance and flexible use of space was positive and significant. Participants whose workplaces located close to kitchen/coffee area, printing area or supervisor's office reported:

- Having sufficient type of space ( $p < 0.01$ );
- Having suitable place as needed ( $p < 0.01$ );
- Having suitable place for meeting, conversation and collaborative work ( $p < 0.05$ ).

The low level of speech privacy was significantly associated with high level of visual exposure ( $p < 0.01$ ).

Bigger size of workstation for holding face-to-face meeting was associated with:

- More positive feeling of being important to the boss ( $p < 0.01$ );
- More confident with their background ( $p < 0.05$ ).

Moreover, employees perceived more comfortable sense of having different background with others ( $p < 0.01$ ) also positively related to being able to personalize workplace.

Those who had adequate storage space reported more positive feeling of being valued by the boss ( $p < 0.05$ ).

Having enough type of space as required for meeting, collaboration and conversation at workplace was associated with:

- More comfortable feeling with their background at work ( $p < 0.01$ );



- Feel fit in the organization pretty well ( $p < 0.01$ );
- Being valued by the chief ( $p < 0.01$ ).

The people experienced high level of exposure to hear colleagues talking or speaking on phone felt less misfit in social situation ( $p < 0.01$ ).

High level of speech privacy at work along with:

- Positive feeling of work was valued in general ( $p < 0.05$ );
- Fit in the organization very well ( $p < 0.01$ ).

High level of perceived satisfaction with ambient physical environment was positively and significantly associated with:

- Big size of workstation ( $p < 0.01$ );
- High level of flexibility to use workplace as needed for meeting or other kind of conversation ( $p < 0.01$ );
- High level of availability to personalize workplace ( $p < 0.01$ );
- High level of visual dominance ( $p < 0.01$ );
- Short functional distance to service area and boss office ( $p < 0.01$ ).

High level of perceived enjoyable work was significantly associated with:

- High level of availability to use meeting space as needed ( $p < 0.05$ );
- High level of capability to personalize workplace ( $p < 0.05$ ).

High level of perceived self-fulfillment was positively associated with short distance to service area like kitchen or copy/printing area ( $p < 0.05$ ).

High level of job satisfaction was related to:

- Larger workstation to hold face to face meeting ( $p < 0.01$ );
- Having sufficient types of place for meeting ( $p < 0.01$ );
- Always having available meeting place as needed ( $p < 0.01$ );
- Can always find a suitable place for certain type of conversation ( $p < 0.01$ );
- Having short distance between service areas ( $p < 0.01$ ) or supervisors' office ( $p < 0.05$ ) and individual workplace.

Perceived high level of commitment to organization was positively associated with:

- Always having available meeting place as needed ( $p < 0.05$ );
- High level of visual dominance over the entire workplace and outdoor view ( $p < 0.01$ ).

Perceived high level of individual work performance was related to:

- High level of flexibility to use space for meeting, certain type of conversation or collaborative work as needed ( $p < 0.01$ );
- Also related to short distance copy or printing area ( $p < 0.05$ ).

The associations between satisfaction with ambient physical environment and organizational outcomes were significant at  $p < 0.01$ , except individual work performance at  $p < 0.05$ .

High level of perceived organizational commitment was associated with:

- Greater individual work performance ( $p < 0.01$ );
- Highly motivated ( $p < 0.01$ );
- Reported higher job satisfaction ( $p < 0.01$ ).

## 5.2 Confirmatory factor analysis

The data were analyzed with the AMOS 21.0 using raw data that were collected through the field survey. The causal model in this study consisted of twelve structural variables corresponding to the twelve constructs: job satisfaction, work motivation, sense of belonging, amount of available space, flexible use of space, availability to personalize, visual dominance and speech privacy.

The present analysis followed a two-step procedure approach for performing path analysis with latent variables, which was recommended by Anderson and Gerbing (1988). In the first step, confirmatory factor analysis was used to develop a measurement model that demonstrated an acceptable fit to the data. In the measurement model, each latent construct could correlate with every other latent construct, and none of the causal relationship was specified between the latent constructs. Once the developed measurement model showed an acceptable fit, moving to the second step.

In the second step, the measurement model was modified so that it came to represent the theoretical (causal) model of interest. This theoretical model then was tested and revised until a theoretically meaningful and statistically acceptable model has been found.

### The initial measurement model

Maximum Likelihood Estimation was adapted to estimate the initial measurement model. The results showed the ratio of obtained chi-square (chi-square/df) value to its degree of freedom was 1.758 with a comparative index of 0.902, a standardized root mean square residual (SRMR) of 0.0611, and a root mean square error (RMSE) of approximation of 0.056. The absolute values of critical ratio for each factor loading exceeded 1.96, from 5.656 to 18.622. The distribution of standardized residuals was symmetrical and centered on zero. 11 standardized residual exceeded 2, and one of them exceeded 4. The model estimation results demonstrated that there was in fact a problem with the model's fit.

The results of initial measurement model fit indicated that one of the manifest indicators to measure amount of available space showed a potential change would have large influence on model's fit. It was removed from the measurement model. The measurement model re-estimated.

### The revised measurement model 1

Goodness of fit indices for the re-specified measurement model showed that the revised measurement model displayed the value of comparative fit index (CFI) increased to 0.920. The ratio of chi-square to its degree of freedom decreased to 1.646. Values of root mean square error of approximation and standardized root mean square residual decreased to 0.052 and 0.0586 respectively after eliminated A1. However, the results of revised measurement model fit estimation were still not satisfactory.

### The revised measurement model 2

After deleting the questionable manifest indicator, the model fit was calculated again. The goodness of fit indices of revised measurement model 2 were presented in Table 5.1. This table showed a ratio of obtained chi-square value to its degree of freedom was 1.539 with a comparative fit index of 0.936, a standardized root mean square residual of 0.0550, and a root mean square error of approximation of 0.047.

Therefore, the revised measurement model 2 was tentatively accepted as the final measurement model for this study, and a number of tests were conducted to assess its reliability and validity.

Table 5.1 The goodness of fit and parsimony indices for the studied models

Model	chi-square/ df	CFI	SRMR	RMSEA	PRATOP
M <sub>i</sub> Initial measurement model	1.758	.902	.0611	.056	.810
M <sub>r1</sub> Revised model 1	1.646	.920	.0580	.052	.800
M <sub>m</sub> Measurement model	1.539	.936	.0550	.047	.789

The standardized regression weights for the manifest indicator variables appeared in the first column of Table 5.2. The Amos provides approximate standard errors for non-standardized estimates, which allows large-sample critical ratio tests of the null hypothesis. If the appropriate distributional assumptions are met, the critical ratio has a standard normal distribution under the null hypothesis that the parameter has a population value of zero. The critical ratio scores obtained for the estimates in Table 5.2 ranged from 6.086 to 18.678. This indicated that all regression weights were significant at ( $p < 0.0001$ ). This finding provided the evidence to support the convergent validity of the indicators.

The Table 5.2 also provided the reliabilities of the indicators (the squared multiple correlations), along with coefficient reliability for each latent construct. All of the eight scales demonstrated the acceptable levels of reliability with coefficients greater than 0.70.

Combined, these findings generally supported the reliability and validity of the constructs and their indicators. Therefore, the revised measurement model 2 was retained to be the final measurement model against other models would be compared.

Table 5.2 Properties of revised measurement model 2

Constructs and Indicators <sup>a</sup>	Standardized Estimates	Critical Ratio <sup>b</sup>	Reliability (R <sup>2</sup> )
Amount of available space (.700)			
A2	.896	6.086	.280
A3	.529	---	.803
Flexible use of space (.904)			
F1	.820	15.494	.672
F2	.982	18.678	.964
F3	.824	---	.679
Personalize (.761)			
P1	.875	11.054	.772
P2	.496	7.507	.247
P3	.869		.755
Distance (.749)			
D1	.761	8.711	.580

D2	.608	7.857	.369
D3	.756	---	.571
Speech privacy (.766)			
SP1	.625	8.240	.391
SP2	.975	7.447	.958
SP3	.596	---	.355
Work motivation (.803)			
WM2	.806	---	.650
WM3	.712	10.864	.508
WM4	.755	11.540	.570
Sense of belonging (.811)			
SB1	.675	---	.456
SB2	.521	7.070	.272
SB3	.621	8.260	.385
SB4	.742	9.558	.550
SB5	.705	9.189	.497
SB6	.647	8.556	.418
Job satisfaction (.858)			
JS1	.672	---	.451
JS2	.982	12.463	.964
JS3	.810	11.514	.656

a: Cronbach's alpha.

b: The critical ratio is available for a constrained manifest indicator variable.

### 5.3 Structural equation model analysis

The results of goodness of fit indices for the initial theoretical model were presented in Table 5.3. The ratio of obtained chi-square value to its degree of freedom was 1.551. Values on CFI, Incremental Fit Index (IFI) and Tucker-Lewis Index (TLI) were greater than 0.90, RMSEA met the cut off value of 0.05, SRMR was lower than 0.06 and PRATIO was relatively high. The critical ratio of each indicator's factor loading was larger than 1.96. Above indices were considered as acceptable for initial theoretical model.

Table 5.3 Goodness of fit indices for initial theoretical model

Goodness of fit indices	Initial theoretical Model
CFI	.934
IFI	.936
TLI	.918

RMSEA	.048
SRMR	.057
PRATIO	.846

In addition, the chi-square difference test between the theoretical model and the measurement model was performed to estimate the validity of the theoretical model. If there is no significant difference, the theoretical model is successful in accounting for the observed relationships.

Thus, the chi-square of the measurement model was subtracted by the chi-square of the theoretical model with the resulting chi-square difference value of  $538.198 - 527.710 = 10.488$ . The degree of freedom for this test was equal to the difference between the degree of freedom of theoretical model and measurement model, in this case  $347 - 343 = 4$ . The critical chi-square value with  $df = 4$  was 18.467 at  $p = 0.001$  so that this chi-square difference was not significant.

In general, these results showed that the initial combined theoretical model provided an acceptable fit to the data. Therefore, this initial theoretical model succeeded in accounting for the observed relationships among the latent constructs.

### 5.3.1 Spatial factors of workplace impact on sense of belonging

The purpose of performing the causal path analysis from workplace factors (amount of available space, flexible use of space, availability to personalize, functional distance, visual dominance and speech privacy) to sense of belonging was testing hypothesis  $H_{11}$ , and identifying which workplace factor relates to employees' sense of belonging and how the spatial factors relate to each other. These spatial features and sense of belonging were latent constructs, which were measured by the manifest indicator variables. The results of these linear equation tests were represented in Table 5.4.

Table 5.4 Model between workplace features and sense of belonging

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
Amount – Belonging	-.093	-.942	.346	$H_{11a}$
FlexibleU – Belonging	-.142	-1.582	.114	$H_{11b}$
Personalize – Belonging	.016	.217	.828	$H_{11c}$
Distance – Belonging	<b>-.234</b>	<b>-2.733</b>	<b>.006</b>	<b><math>H_{11d}</math></b>
VD – Belonging	<b>-.179</b>	<b>-2.494</b>	<b>.013</b>	<b><math>H_{11e}</math></b>
SpeechP – Belonging	.037	.522	.602	$H_{11f}$

Amount: Amount of available space

FlexibleU: Flexible use of space  
Personalize: Availability to personalize  
Distance: Functional distance  
VD: Visual dominance  
SpeechP: Speech privacy  
Belonging: Sense of belonging

The standardized path coefficient for causal path from amount to sense of belonging, from flexible use of space to sense of belonging, from availability to personalize to sense of belonging and speech privacy to sense of belonging were -0.093, -0.142, 0.016 and 0.037 respectively. Their obtained absolute values of critical ratio were too small to reach the cut off value 1.96, thus not reliable. And their obtained p values were not significant at any significance level. Meaning that the following null hypotheses were not rejected.

H<sub>011a</sub>: Amount of available space doesn't significantly and positively relate to sense of belonging;

H<sub>011b</sub>: Flexible use of space doesn't significantly relate to sense of belonging;

H<sub>011c</sub>: Availability to personalize workplace doesn't significantly relate to sense of belonging;

H<sub>011f</sub>: Speech privacy doesn't significantly relate to sense of belonging.

Both causal paths from functional distance to sense of belonging, and from visual dominance to sense of belonging had standardized path coefficient significant at  $p = 0.011$  level with value of -0.234 and -0.179 respectively. And the absolute values of critical ratio for these two causal paths exceeded 1.96. The null hypotheses of H<sub>0d</sub> and H<sub>0e</sub> were rejected.

H<sub>011d</sub>: Functional distance doesn't significantly relate to sense of belonging;

H<sub>011e</sub>: Visual dominance doesn't significantly relate to sense of belonging.

There were two significant relationships: between functional distance and sense of belonging, and between visual dominance and sense of belonging. The standardized estimate for the causal path from distance to sense of belonging was -0.234, meaning that functional distance negatively related to sense of belonging. The value of standardized path coefficient for visual dominance to sense of belonging was -0.179, which demonstrated visual dominance negatively related to sense of belonging in workplace.

Consequently, one of the effective ways to improve the employees' sense of belonging was to short the distance between the employees and their supervisor; to short the distance between the employees and public service area like copy/printing zone, coffee corner and kitchen. Another effective option to enhance the employees' sense of belonging was to increase the

degree of visual dominance over the whole office and having direct visual contact to outdoor view.

The results of the path analysis from workplace factors to sense of belonging were summarized and represented in Figure 5.1.

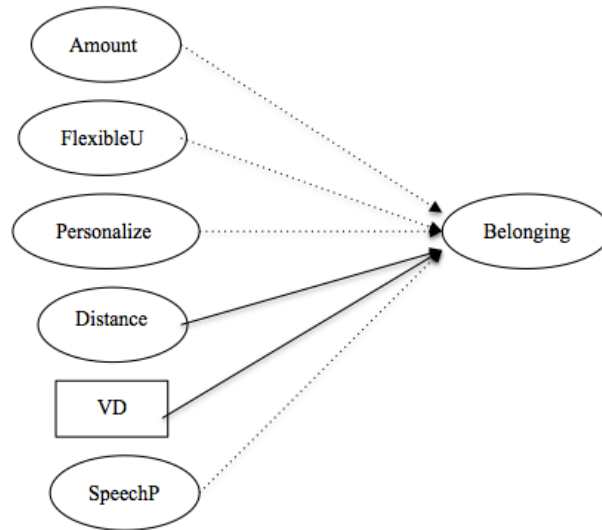
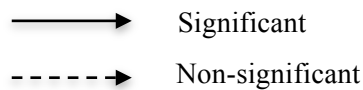


Figure 5.1 Model for workspace features impact on sense of belonging



### 5.3.2 Spatial features relate to satisfaction with ambient environment

There were six linear equations between physical workplace environment characteristics and satisfaction with ambient environment. This section aimed to investigate of relationships between workplace characteristics variables (amount of available space, flexible use of space, availability to personalize, functional distance, visual dominance and speech privacy), and satisfaction with ambient environment. The listed hypotheses  $H_{12a}$  to  $H_{12f}$  were tested in this analysis. Estimated parameters were appeared in Table 5.5.

Hypothesis  $H_{12a}$ : Amount of available space is significantly associated with satisfaction with ambient environment;

Hypothesis  $H_{12b}$ : Flexible use of space is significantly associated with satisfaction with ambient environment;

Hypothesis  $H_{12c}$ : Availability to personalize is significantly associated with satisfaction with ambient environment;



Hypothesis H<sub>12d</sub>: Functional distance is significantly associated with satisfaction with ambient environment;

Hypothesis H<sub>12e</sub>: Visual dominance is significantly associated with satisfaction with ambient environment;

Hypothesis H<sub>12f</sub>: Speech privacy was significantly associated with satisfaction with ambient environment.

Table 5.5 Model from workplace features to satisfaction with ambient environment

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
Amount – SE	<b>.349</b>	<b>3.614</b>	<b>&lt; .0001</b>	<b>H<sub>12a</sub></b>
FlexibleU – SE	.130	1.721	.085	H <sub>12b</sub>
Personalize – SE	<b>.134</b>	<b>2.236</b>	<b>.025</b>	<b>H<sub>12c</sub></b>
Distance – SE	<b>.229</b>	<b>3.418</b>	<b>&lt; .0001</b>	<b>H<sub>12d</sub></b>
VD – SE	<b>.147</b>	<b>2.628</b>	<b>.009</b>	<b>H<sub>12e</sub></b>
SpeechP – SE	-.051	-.900	.368	H <sub>12f</sub>

Amount: Amount of available space

FlexibleU: Flexible use of space

Personalize: Availability to personalize

Distance: Functional distance

VD: Visual dominance

SpeechP: Speech privacy

SE: Satisfaction with ambient environment

The Table 5.5 showed that flexible use of space (C.R = 1.721, *p* = 0.085) and speech privacy (C.R = -0.900, *p* = 0.368) were not significantly related to satisfaction with ambient environment. The null hypothesis of H<sub>02b</sub> and H<sub>02f</sub> were not rejected. In other words, the hypothesis H<sub>2b</sub> and H<sub>2f</sub> were not supported by the data.

However, the other four characteristics were found positively associated with satisfaction with ambient environment and significant at 0.05 or lower level. Both amount of available space and functional distance had C.R. greater than 3 and significant at *p* < 0.0001 level with standardized path coefficient of 0.349 and 0.229 respectively. Availability to personalize the workplace and visual dominance were positively associated with satisfaction with ambient environment. Availability to personalize was significant at *p* = 0.025, C.R. = 2.236, with standardized estimates of 0.134. Visual dominance was significant at *p* = 0.009, C.R. = 2.628, with standardized path coefficient of 0.147.

Combined, all the hypotheses of relationships between spatial features and satisfaction with ambient environment were supported (H<sub>12a</sub>, H<sub>12c</sub>, H<sub>12d</sub>, and H<sub>12e</sub>), except (H<sub>12b</sub> and H<sub>12f</sub>, H<sub>12b</sub> and H<sub>12f</sub>). Path analyses for this section were summarized in Figure 5.2.

Raising the amount of available space of individual workplace for storage, face-to-face meeting or spread over work material could improve workers' perceived satisfaction with ambient physical environment. Additionally, providing higher availability of flexible use of space, personalize workplace and visual dominance were also helpful to enhance satisfaction with ambient physical environment. Those who located close to the boss or public areas, having more potential opportunities to communicate and interact, reported higher satisfaction of overall physical workplace environment.

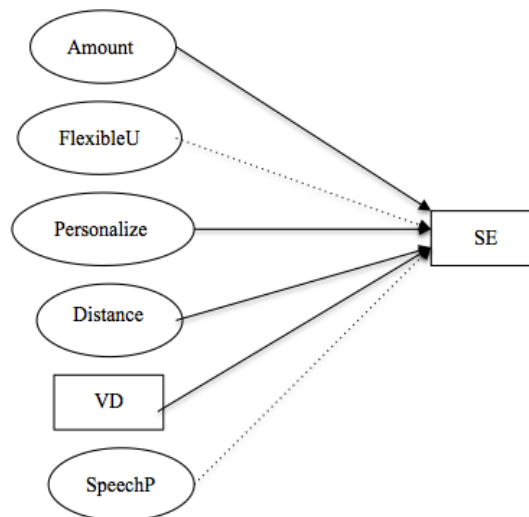


Figure 5.2 Model for workspace features impact satisfaction with ambient environment

—————> Significant      - - - - -> Non-significant

### 5.3.3 Spatial characteristics of workplace influencing organizational outcomes

In order to test the hypotheses of workplace features (available amount of space, flexible use of space, functional distance, personalize, visual dominance and speech privacy) affect organizational outcomes (commitment, work motivation, job satisfaction and work performance), a set of analyses was performed between spatial characteristics and organizational outcomes based on Maximum Likelihood method.

#### Workplace features – Commitment

Hypothesis of spatial factors significantly and positively influence on organizational commitment was examined in this part. The critical parameters, like standardized estimates, possibility of casual paths from spatial features to commitment were tested and presented in Table 5.6.

Table 5.6 Model from workplace factors to commitment

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
Amount – CO	-.075	-.817	.414	H <sub>21a</sub>
FlexibleU – CO	.073	.946	.344	H <sub>21b</sub>
Personalize – CO	-.005	-.072	.943	H <sub>21c</sub>
<b>Distance – CO</b>	<b>-.171</b>	<b>-2.176</b>	<b>.030</b>	<b>H<sub>21d</sub></b>
VD – CO	.051	.809	.419	H <sub>21e</sub>
SpeechP – CO	-.063	-1.031	.303	H <sub>21f</sub>

Amount: Amount of available space  
FlexibleU: Flexible use of space  
Personalize: Availability to personalize  
Distance: Functional distance  
VD: Visual dominance  
SpeechP: Speech privacy  
CO: Commitment

The Table 5.6 represented the results of analysis between six workplace features and employees' commitment. From the results, it was easily understood how spatial characteristics impact on organizational commitment. By checking out the level of significance column (*p*-value), there was only one value smaller than 0.05, and the absolute value of its critical ratio was larger than 1.96. Meaning that this spatial feature was significantly related to commitment.

In other words, functional distance was significantly influenced employees' commitment at  $p = 0.030$ , with critical ratio of -2.176 and standardized estimates of -.171. Meaning that functional distance was negatively associated with commitment. Functional distance increased 17.1% while the employees' organizational commitment decreasing. H<sub>21d</sub> was identified as the only hypothesis that supported by the data in H<sub>21</sub> group of hypotheses.

The employees located far away from their boss/supervisor, and printing and coffee area reported lower degree of commitment to their organization.

#### Workplace features – Work motivation

The results of the path analyses between the proposed six spatial factors and work motivation were presented in table 5.7. Null hypotheses were listed below:

- H<sub>022a</sub>: Amount of available space doesn't significantly impact on work motivation;
- H<sub>022b</sub>: Flexible use of space doesn't significantly impact on work motivation;
- H<sub>022c</sub>: Personalization doesn't significantly impact on work motivation;
- H<sub>022d</sub>: Functional distance doesn't significantly impact on work motivation;
- H<sub>022e</sub>: Visual dominance doesn't significantly impact on work motivation;

H<sub>022f</sub>: Speech privacy doesn't significantly impact on work motivation;

Table 5.7 Model from workplace features to work motivation

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
Amount – WorkM	-.181	-1.662	.097	H <sub>22a</sub>
FlexibleU – WorkM	.143	1.630	.103	H <sub>22b</sub>
Personalize – WorkM	.073	.997	.319	H <sub>22c</sub>
Distance – WorkM	-.027	-.312	.755	H <sub>22d</sub>
VD – WorkM	-.076	-.955	.339	H <sub>22e</sub>
SpeechP – WorkM	-.046	-.678	.498	H <sub>22f</sub>

Amount: Amount of available space  
FlexibleU: Flexible use of space  
Personalize: Availability to personalize  
Distance: Functional distance  
VD: Visual dominance  
SpeechP: Speech privacy  
WorkM: Work motivation

Table 5.7 indicated that among these tested path analyses, the *p*-values of all these relationships were larger than 0.05. Moreover, none of the obtained absolute value of C.R. was greater than the cut value 1.96. This meant none of the null hypotheses (H<sub>022a</sub> to H<sub>022f</sub>) that workplace spatial factor doesn't significantly affect work motivation, was rejected. Hence there was no evidence to demonstrate that amount of available space, flexible use of space, availability to personalize workplace, speech privacy and functional distance had effects on work motivation at any significance level. Hypothesis of spatial features significantly influence work motivation was supported by data. Therefore, spatial features were not significantly impact work motivation in present research.

#### Workplace features – Work performance

This part was to study how the workplace factors impact work performance in the proposed research. Hypothesis of spatial features significantly affect individual work performance was examined by testing paths analysis from spatial characteristics to work performance.

The results from paths analysis were presented in Table 5.8. The column of C.R. showed all the critical ratios of casual path from workplace features to work performance were smaller than the cut value of 1.96 except the flexible use of space. The *p*-value of flexible use of space was smaller than 0.05 as well. Meaning that the flexible use of space was positively and significantly influenced work performance at *p* = 0.038, the critical ratio was greater than 1.96

with value of 2.074. The standardized regression weight of flexible use of space predicting work performance was 0.164.

Consequently, increasing the availability of flexible use of space could improve perceived individual work performance, i.e. providing various types of space for meeting or certain type of conversation, and providing employees with sufficient possibility to use space for work needs.

Table 5.8 Model from workplace features to individual work performance

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
Amount – WP	-.022	-.238	.812	H <sub>23a</sub>
<b>FlexibleU – WP</b>	<b>.164</b>	<b>2.074</b>	<b>.038</b>	<b>H<sub>23b</sub></b>
Personalize – WP	.056	.832	.405	H <sub>23c</sub>
Distance – WP	.017	.217	.829	H <sub>23d</sub>
VD – WP	.024	.378	.706	H <sub>23e</sub>
SpeechP – WP	-.046	-.733	.464	H <sub>23f</sub>

Amount: Amount of available space  
FlexibleU: Flexible use of space  
Personalize: Availability to personalize  
Distance: Functional distance  
VD: Visual dominance  
SpeechP: Speech privacy  
WP: Work performance

#### Workplace features – Job satisfaction

Proposed structural equation model between workplace features and job satisfaction aimed to test the hypothesis that spatial characteristics significantly influence job satisfaction by using Maximum Likelihood Estimation.

The path coefficients were presented in Table 5.9. Table 5.9 also demonstrated the critical ratio for each dependent variable. It was found that only two dependent variables (available amount of space and flexible use of space) succeed to show validity during path analysis with C.R. larger than 1.96, and both of them significant at  $p < 0.05$ .

Table 5.9 Model between space features and job satisfaction

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
<b>Amount – JobS</b>	<b>-.356</b>	<b>-3.105</b>	<b>.002</b>	<b>H<sub>24a</sub></b>
<b>FlexibleU – JobS</b>	<b>.222</b>	<b>2.746</b>	<b>.006</b>	<b>H<sub>24b</sub></b>
Personalize – JobS	.027	.420	.675	H <sub>24c</sub>
Distance – JobS	-.051	-.672	.502	H <sub>24d</sub>
VD – JobS	-.073	-1.192	.233	H <sub>24e</sub>

SpeechP – JobS	-.055	-.923	.356	H <sub>24f</sub>
----------------	-------	-------	------	------------------

Amount: Amount of available space  
 FlexibleU: Flexible use of space  
 Personalize: Availability to personalize  
 Distance: Functional distance  
 VD: Visual dominance  
 SpeechP: Speech privacy  
 JobS: Job satisfaction

Regarding the predicted relationships between workspace design features and job satisfaction, the results indicated that the availability to personalize, functional distance, visual dominance and speech privacy have no effects on job satisfaction (H<sub>24c</sub>, H<sub>24d</sub>, H<sub>24e</sub> and H<sub>24f</sub> were not supported).

The amount of available space and availability to personalize workplace showed significant effects on job satisfaction evaluation at  $p = 0.002$  and  $p = 0.006$  (H<sub>24a</sub> and H<sub>24b</sub> were supported). Amount of available space was negatively associated with self-report job satisfaction with path coefficient of -0.356. Increasing the availability of flexible use of space could help to improve the job satisfaction with path coefficient of 0.222.

In order to improve the level of job satisfaction, enlarging the size of individual workstation to hold face to face meeting, individual storage space, and offering various types of spaces and enough possibility to freely use space for meeting, conversation and collaborative work needs are the effective ways.

Figure 5.3 summarized the results of structural equation model analysis for studying the relationships between the spatial features and knowledge workers reported organizational outcomes in a direct visible version. Only the significant relationships were presented by solid arrows.

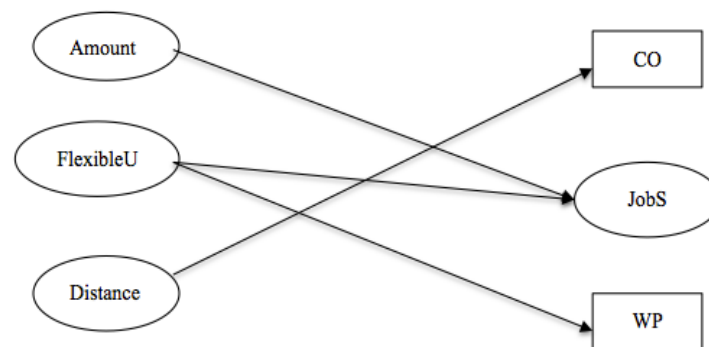


Figure 5.3 Model for workspace spatial features impact organizational outcomes

—→ Significant

### 5.3.4 Sense of belonging associate with organizational outcomes

In the study of sense of belonging associated with organizational outcomes, sense of belonging worked as a predictor to the organizational outcomes (commitment, work motivation, job satisfaction and work performance). Structural equation modeling analyses were carried out between sense of belonging and the four factors of organizational outcomes to study the proposed relationships. In this section, the latent variables that involved in the data analyses included one manifest structural variable and three structural variables. Table 5.10 presented the estimated standardized path coefficient and other significant parameters of the proposed structural equation model.

Table 5.10 Model between sense of belonging and organizational outcomes

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
<b>Belonging - CO</b>	<b>-.452</b>	<b>-5.685</b>	<b>&lt; .0001</b>	<b>H<sub>31a</sub></b>
<b>Belonging - WorkM</b>	<b>-.474</b>	<b>-5.095</b>	<b>&lt; .0001</b>	<b>H<sub>31b</sub></b>
<b>Belonging - JobS</b>	<b>-.356</b>	<b>-4.506</b>	<b>&lt; .0001</b>	<b>H<sub>31c</sub></b>
<b>Belonging - WP</b>	<b>-.236</b>	<b>-3.118</b>	<b>.002</b>	<b>H<sub>31d</sub></b>

Belonging: Sense of belonging  
CO: Commitment  
WorkM: Work motivation  
JobS: Job satisfaction  
WP: Work performance

Table 5.10 showed all of the following null hypotheses were rejected with *p*-value of 0.002 level or smaller. All of the absolute values of critical ratio were greater than 3.

H<sub>031a</sub>: Sense of belonging does not significantly associate with commitment;

H<sub>031b</sub>: Sense of belonging does not significantly associate with work motivation;

H<sub>031c</sub>: Sense of belonging does not significantly associate with job satisfaction;

H<sub>031d</sub>: Sense of belonging does not significantly associate with work performance.

Hypotheses H<sub>31</sub> of sense of belonging significantly affect organizational outcomes was supported by the data. The sense of belonging was identified as a strong predictor to knowledge workers' commitment, work motivation, job satisfaction and work performance. Figure 5.4 presented the model of sense belonging influence organizational outcomes.

Thus, enhancing employees' perceived sense of belonging at workplace was meaningful and effective to improve their commitment, work motivation, job satisfaction and work performance.

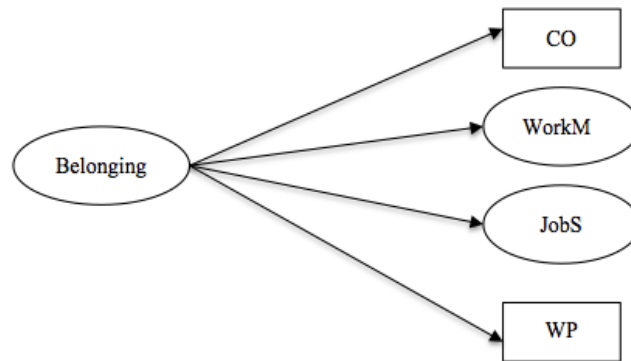


Figure 5.4 Model of sense of belonging influence organizational outcomes

—————→ Significant

### 5.3.5 Satisfaction with ambient physical environment associate with organizational outcomes

This section explored the relationships between satisfaction with ambient physical environment and commitment, work motivation, job satisfaction and work performance. Hypothesis H<sub>32</sub>: satisfaction with ambient physical environment significantly associates with organizational outcomes was tested by structural equation model analysis.

The results from structural equation modeling of satisfaction with ambient physical environment associated with organizational outcomes were appeared in Table 5.11.

Table 5.11 Model from satisfaction of ambient physical environment to organizational outcomes

	Standardized Estimates	Critical Ratio	<i>p</i> -value	Hypotheses
SE - CO	.121	1.574	.116	H <sub>32a</sub>
<b>SE - WorkM</b>	<b>.282</b>	<b>3.195</b>	<b>.001</b>	<b>H<sub>32b</sub></b>
<b>SE- JobS</b>	<b>.460</b>	<b>5.405</b>	<b>&lt; .0001</b>	<b>H<sub>32c</sub></b>
SE - WP	-.023	-.288	.774	H <sub>32d</sub>

SE: Satisfaction with ambient physical environment

CO: Commitment

WorkM: Work motivation

JobS: Job satisfaction

WP: Work performance

The results presented in Table 5.11 didn't have enough evidence to proof that satisfaction with ambient physical environment significantly and directly associated with the employees' commitment to their organization. The results from the data analysis showed that satisfaction with ambient physical environment didn't relate to performance, which didn't support the



previous finding that satisfaction with physical environment significantly influence work performance (Lee & Brand, 2005).

Nevertheless, the results demonstrated that satisfaction with ambient physical environment strongly and significantly predicts the workers' job satisfaction at  $p < 0.0001$  level. Satisfaction with ambient physical environment contributed 46% to increase the job satisfaction in this study. Moreover, satisfaction with ambient physical environment was identified as a strong indicator to work motivation as well. It was significant at  $p = 0.001$  level. And the result was reliable with the critical ratio larger than 3.19. Figure 5.5 demonstrated the model of satisfaction with physical ambient environment associated with the organizational outcomes.

Therefore, increasing the level of perceived satisfaction with ambient physical environment was effective to improve work motivation and job satisfaction in knowledge intensive industries.

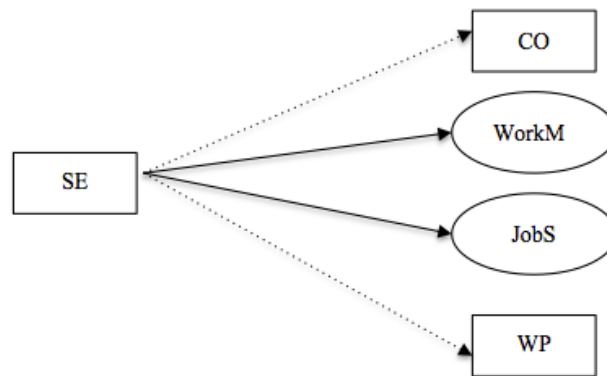


Figure 5.5 Model of satisfaction with ambient physical environment influence organizational outcomes

## 5.4 Mediating effect

The mediating effect of sense of belonging between workplace spatial factors and organizational outcomes was examined in this section. Two spatial factors have been found significantly and positively impact sense of belonging in precedent analysis. Moreover, the associations between sense of belonging and all the aspects of organizational outcomes were significant and positive as well.

### 5.4.1 Direct effects

The preceding chapter 5.3.1 demonstrated that functional distance and visual dominance significantly impact sense of belonging. The following chapter 5.3.3 proofed that spatial features like amount of available space and flexible use of space directly and significantly affect

job satisfaction. Furthermore, flexible use of space had significant effects on work performance; Besides, the functional distance was found significantly impacts organizational commitment; Additionally, there was no enough evidence to show that the spatial characteristics had significant impacts on work motivation. The chapter 5.3.4 provided strong evidences to support sense of belonging significantly associates with the four aspects of organizational outcomes. The overall inter correlations among the spatial factors, sense of belonging and organizational outcomes were presented in Figure 5.6.

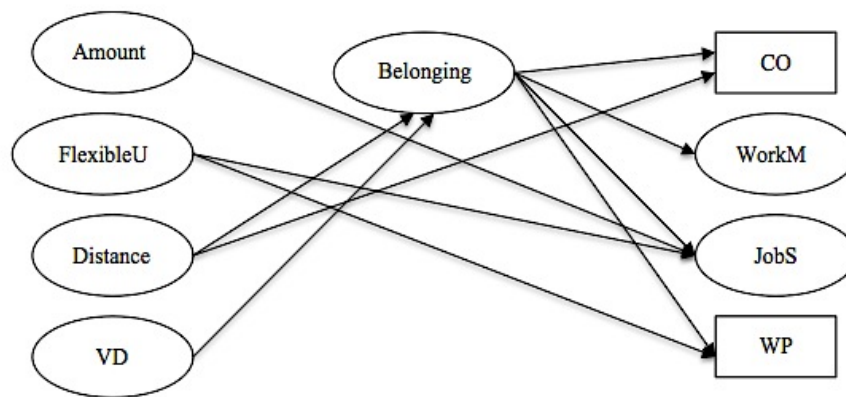


Figure 5.6 Path analyses between spatial features, sense of belonging and organizational outcomes

→ Significant

#### 5.4.2 Indirect effects

Figure 5.7 presented that the organizational outcomes were not only influenced by direct effects, but also influenced by the indirect effects. All of the indirect effects of spatial factors that affected organizational outcomes via sense of belonging in the model were calculated and analyzed below.

**Indirect effect of functional distance – sense of belonging – commitment:**

$$-0.234 * -0.452 = 0.11;$$

**Indirect effect of visual dominance – sense of belonging – commitment:**

$$-0.179 * -0.452 = 0.08;$$

**Indirect effect of functional distance – sense of belonging – work motivation:**

$$-0.234 * -0.474 = 0.11;$$

**Indirect effect of visual dominance – sense of belonging – work motivation:**

$$-0.179 * -0.474 = 0.09;$$

Indirect effect of functional distance – sense of belonging – job satisfaction:

$$-0.234 * -0.356 = 0.08;$$

Indirect effect of visual dominance – sense of belonging – job satisfaction:

$$-0.179 * -0.356 = 0.06;$$

Indirect effect of functional distance – sense of belonging – work performance:

$$-0.234 * -0.236 = 0.06;$$

Indirect effect of visual dominance – sense of belonging – work performance:

$$-0.179 * -0.236 = 0.04.$$

According to the size of calculated indirect effects, only three of them were greater than 0.09. Kenny (2013) suggested that the indirect effect 0.01 would be considered as small, 0.09 would be medium and 0.25 would be large. In this study, only the medium to large indirect effects will be discussed. Consequently, there were three groups of meaningful and powerful indirect effects in this model: the indirect effects of functional distance on commitment via sense of belonging; the indirect effects of functional distance on work motivation through sense of belonging; indirect effects of visual dominance on work motivation through sense of belonging.

### **5.4.3 Mediating role of sense of belonging**

This study assumed that the perceived sense of belonging mediates workplace design factors and organizational outcomes. The mediating effects were tested among the meaningful indirect effects that have been identified in last section.

Inter correlations among functional distance – sense of belonging – commitment all yielded significant at  $p < 0.05$ . And functional distance significantly and directly influenced commitment at  $p = 0.030$ . There was a partial mediating effect of sense of belonging. The indirect effect (0.11) of functional distance on commitment through perceived sense of belonging was larger than the direct effect (-0.171). Thus, there was a positive mediating effect of sense of belonging on the relationship between functional distance and commitment.

Therefore, the effects of workplace spatial characteristics on organizational outcomes mediated through the employee perceived sense of belonging in workplace. The mediating effects of sense of belonging were summarized in Figure 5.7.

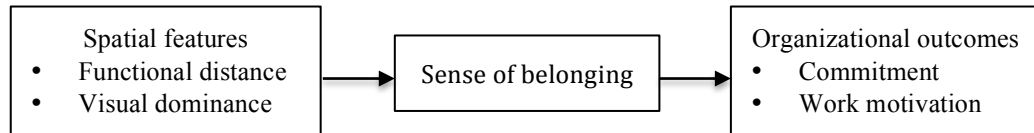


Figure 5.7 Mediating effects of sense of belonging

## 5.5 Summary

All the data collected from the field survey were analyzed by structural equation model (SEM) analysis. The data analysis results were summarized in Figure 5.8. The speech privacy has not been found influence any of the dependent variable at any significant level. Thus, it was not appeared in Figure 5.8. All of the significant relationships were represented in this figure. They either positively or negatively associated with each other. Sense of belonging in this study was measured by negative statements. Therefore, the more negative feeling about the described situation was reported, the more positive sense of belonging was perceived.

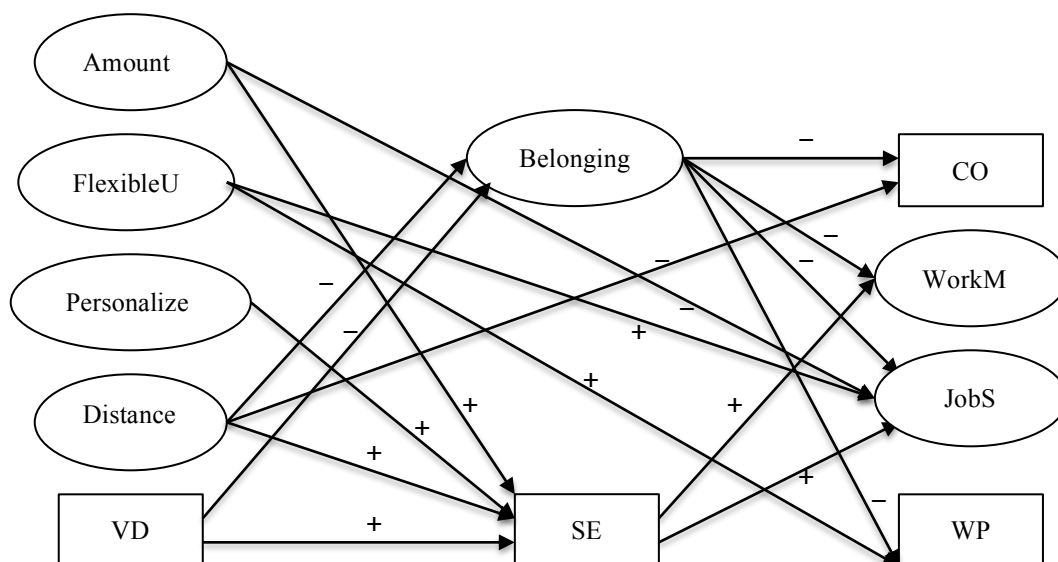


Figure 5.8 Results of SEM analysis

## **Chapter 6**

### **Conclusions**

This chapter summarizes the results of research findings, and draws the final conclusions. Five out of six hypotheses are partially supported by the research findings; only one hypothesis is fully supported by the findings. In conclusion, this study identifies the significance of functional distance and visual dominance in improving sense of belonging, satisfaction of overall workplace and organizational outcomes. The joint effect of these variables plays a fundamental role in an individual's capability to effectively function in organization. It also appears to affect people's psychological response to the workplace. Based on the characteristics of the optimal organizational outcomes and the revealed sensations of the survey participants, design recommendations on workplace layouts are provided and the ways of how to incorporate the research findings into organization management strategies are suggested. At the end of this dissertation, the limitation of this study and its practical implications for future studies are discussed.

#### **6.1 Findings and hypotheses**

In order to design and create a workplace that encourages organizational effectiveness and maximizes the use of human capital, a research model (see Figure 6.1) was developed to study the influences of workplace characteristics on the sense of belonging, employees' satisfaction with their overall physical work environment, and organizational outcomes, such as organizational commitment, work motivation, job satisfaction and work performance.

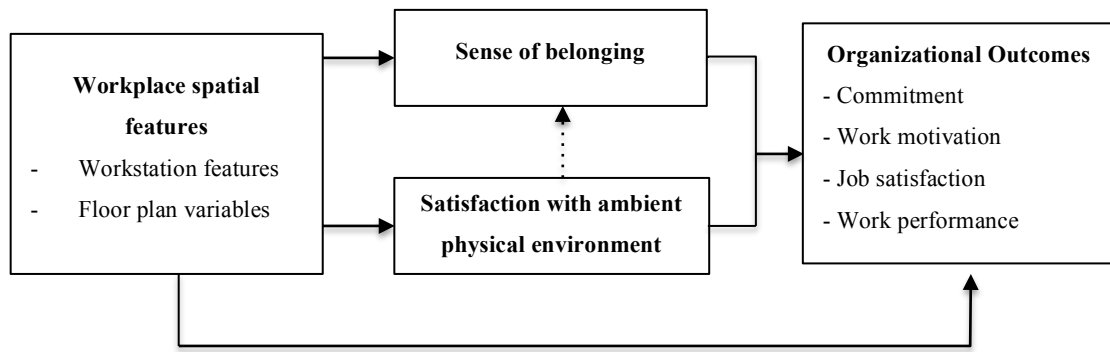


Figure 6.1 Research model

The workplace features were hypothesized significantly influence knowledge workers' sense of belonging, satisfaction with ambient physical environment, and organizational outcomes. Moreover, the sense of belonging was hypothesized to significantly affect organizational outcomes, and to play a mediate role between workplace design characteristics and organizational outcomes. Nevertheless, the ambient physical environment satisfaction was hypothesized to significantly impact organizational outcomes (see Figure 6.2).

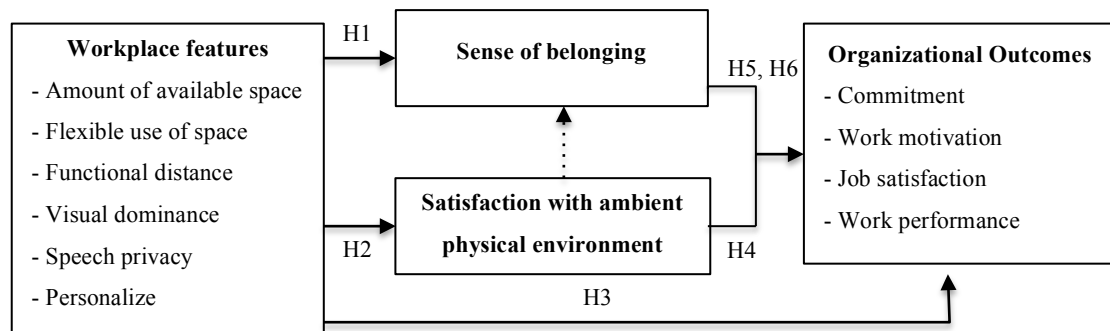


Figure 6.2 Research hypotheses

Hypothesis 1: The workplace features significantly influence on knowledge worker's sense of belonging in current organization;

Question 1: Which workplace features significantly influence knowledge worker's sense of belonging?

Hypothesis 2: The workplace features significantly influence satisfaction with ambient physical work environment;

Question 2: Which workplace features significantly influence satisfaction with ambient physical work environment?

Hypothesis 3: The workplace features significantly influence organizational outcomes;

Question 3: Which workplace features significantly influence four organizational outcomes respectively?

Hypothesis 4: Satisfaction with ambient physical work environment significantly affects organizational outcomes;

Hypothesis 5: Sense of belonging significantly relates to organizational outcomes;

Hypothesis 6: Sense of belonging mediates the workplace features and organizational outcomes.

The hypothesized relationships within the research model were examined using the Structure Equation Model (SEM). Based on the results of the data analysis, particular workplace features affecting the sense of belonging, satisfaction with overall physical work environment, and organizational outcomes were further identified. Among the six hypotheses, only hypothesis 5 (H5) was fully supported by the research findings. The rest were supported by the findings only partially.

Sense of belonging was the key component in the data analysis. Three out of six hypotheses (H1, H5 and H6) examined the sense of belonging associated correlations between workplace spatial characteristics and organizational outcomes.

The first hypothesis (H1) suggested that workplace spatial features significantly influence knowledge workers' sense of belonging, which was partially supported by the research findings. Only two workplace spatial variables were found significantly and directly affect the sense of belonging (see Figure 6.3). Those two were functional distance and visual dominance. They were categorized into the workplace floor plan design variables. The distance from individual workstation to public area and chief's office/work area was statistically considered as strong and consistent predictor to sense of belonging. Convenient locations of service/public area and supervisor's office were helpful to promote a higher level of sense of belonging, which could also foster information circulation, communication, informal interactions, problem-solving and decision making processes. Having visual access to the entire workplace and also to outdoor

view from the workstation was similarly confirmed to be significantly relevant to the sense of belonging.

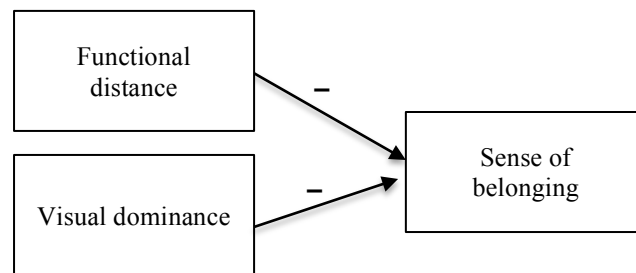


Figure 6.3 Workplace features impact on sense of belonging

The fifth hypothesis (H5) hypothesized that the sense of belonging has significant impacts on organizational outcomes. It was fully supported by the research findings. It was proven that having a sense of belonging is the privilege of succeeding in maximizing organizational outcome, which agrees with previous researches that have claimed that sense of belonging has significant effects on organizational commitment, work motivation, job satisfaction and work performance (Winter-Colins & McDaniel, 2000; Dobbins & Zaccaro, 1986; Edwards & Mullis, 2001; Fischer, 1983; Sundstrom & Sundstrom, 1989; Meyer & Allen, 1991; Mowday, Porter & Steers, 1982). Figure 6.4 presents the findings of sense of belonging influences organizational outcomes.

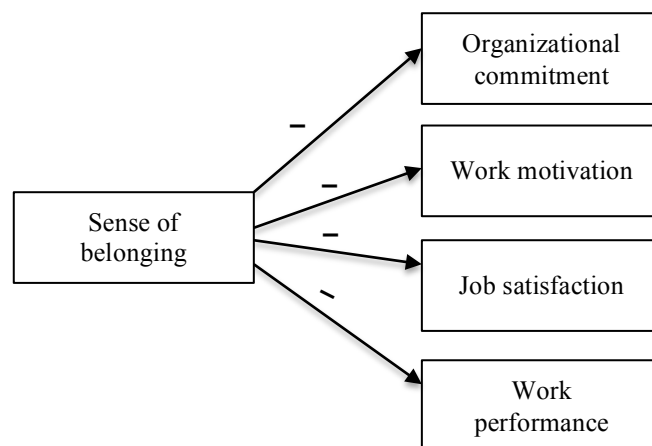


Figure 6.4 Sense of belonging impacts on organizational outcomes

In this study, the sense of belonging was measured by six negative statements. Thus, the negative predictions in figures 6.3 and 6.4 represented positive relationships.

The mediating role of the sense of belonging – the sixth hypothesis (H6) – was partially supported by the results. The mediation effect was analyzed in four steps. The first step examined the direct effects of workplace spatial characteristics on organizational outcomes; the second tested the direct effects of workplace spatial features on sense of belonging; the third



calculated the direct effects of sense of belonging on organizational outcomes; and the last measured the indirect effects of workplace spatial features on organizational outcomes via sense of belonging. Only the meaningful factors were retained and interpreted. Research findings provided enough evidence to conclude that functional distances and visual dominance in workplace influence knowledge worker's organizational commitment and work motivation, which was mediated through perceived sense of belonging (see Figure 6.5). Therefore, an effective method of enhancing the relationship between workplace design and employees' commitment and work motivation is to improve the level of sense of belonging.

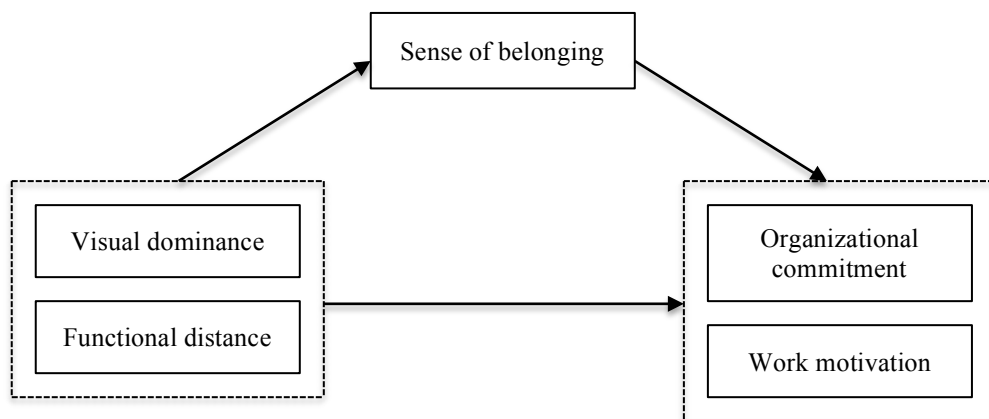


Figure 6.5 Mediating role of sense of belonging

The second hypothesis (H2) assumed that workplace characteristics significantly influence employees' general satisfaction with their ambient physical work environment. This hypothesis was partially supported by the data analysis (see Figure 6.6). Most of the studied spatial features were found significantly affect a person's overall satisfaction with their ambient environment, except flexible use of space for different working purposes and speech privacy. The efficient ways for improving physical environment satisfaction were found to be: providing a larger workstation with sufficient work surface, storage space and being able to hold face-to-face meetings; offering movable furniture, and freedom to move it and decorate the workstation; locating workstations closer to service zones and superior's offices; well orientating the work stations and dealing with the relationship between window and work station to enable visual access to the whole workplace and to an outdoor view.

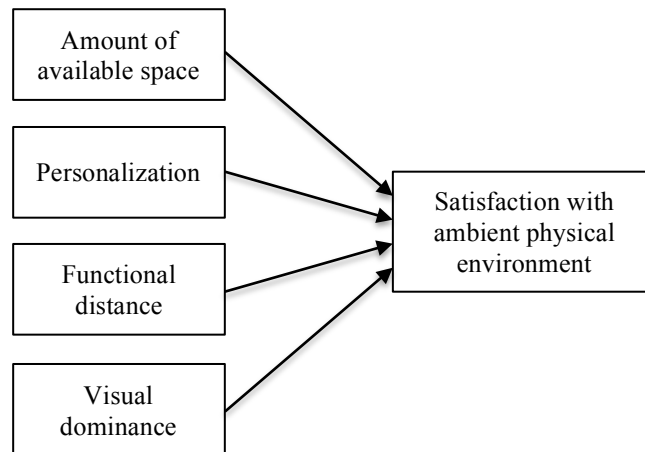


Figure 6.6 Workplace features impact on overall satisfaction with ambient physical environment

The third hypothesis (H3) hypothesized that workplace features significantly impact organizational outcomes. This hypothesis was partially supported by the findings (see Figure 6.7). Functional distance was found as a strong indicator to organizational commitment. None of the studied workplace features were found to have effect on work motivation. Being able to flexibly use space as needed for various working purposes, such as prompting meetings, conversation or collaborative work, was found significantly predict job satisfaction and work performance. Amount of available space within workstation was a strong predictor to work performance as well.

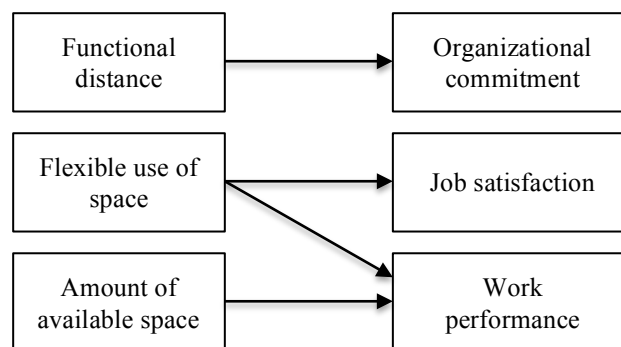


Figure 6.7 Workplace features impact on organizational outcomes

The fourth hypothesis (H4) assumed that satisfaction with ambient physical environment significantly affects organizational commitment, work motivation, job satisfaction and work performance. This hypothesis was partially supported by the findings (see Figure 6.8). Organizational commitment and work performance were not found to be significantly influenced by satisfaction with the overall physical work environment. However, the analysis of

survey data found enough evidence to claim that ambient environment satisfaction significantly influences employees' work motivation and their job satisfaction.

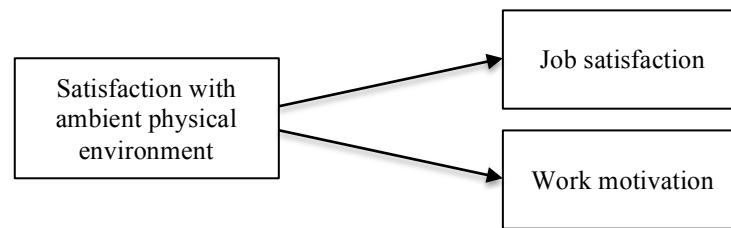


Figure 6.8 Satisfaction with ambient physical environment impacts on organizational outcomes

The research findings identify the model of workplace spatial features influence on sense of belonging and organizational outcomes (see Figure 6.9). The method established in this research to study the relationship between workplace spatial settings, sense of belonging and organizational outcomes is applicable in different types of workplaces worldwide.

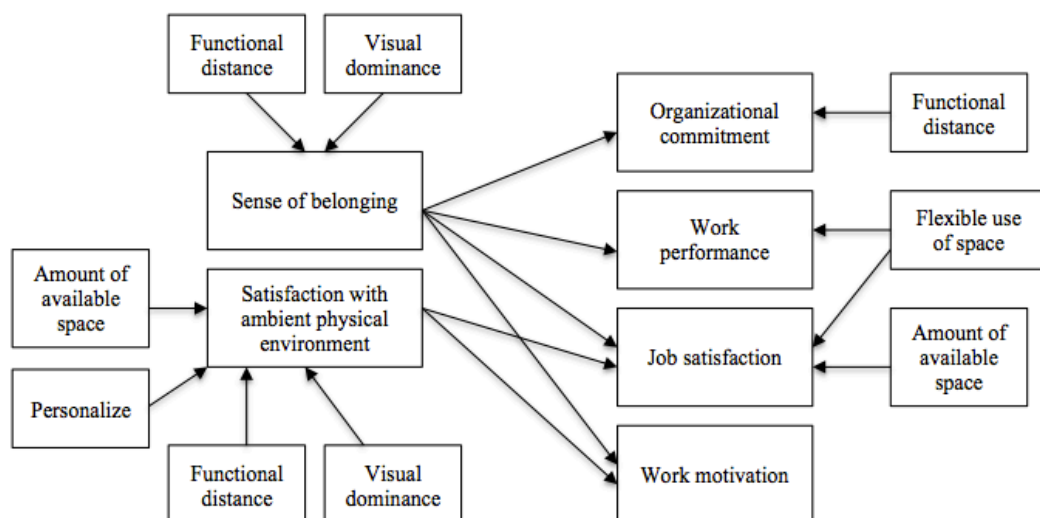


Figure 6.9 Model of workplace spatial features influence on sense of belonging and organizational outcomes

## 6.2 Correlation analysis and spatial features

Based on correlation analysis of all the variables in the research model:

High level of sense of belonging is associated with

- Larger size of workstation for holding face-to-face meeting;
- Being able to personalize their workplace;

- Adequate storage space;
- Having enough types of space as required for meeting, collaboration and conversation;
- High level of exposure to hear colleagues talking or speaking on phone;
- High level of speech privacy.

High level of organizational commitment is associated with

- Always having available meeting place as needed;
- High level of visual dominance over the entire workplace and outdoor view.

High level of work motivation is associated with

- High level of availability to use meeting space as needed;
- High level of capability to personalize workplace;
- Short distance to service area like kitchen or copy/printing area.

High level of job satisfaction is associated with

- Larger workstation to hold face to face meeting;
- Having sufficient types of place for meeting;
- Always having available meeting place as needed;
- Can always find a suitable place for certain type of conversation;
- Having short distance from individual workplace to service areas or supervisors' office.

High level of individual work performance is related to

- High level of flexibility to use space for meeting, certain type of conversation or collaborative work as needed;
- Short distance to copy or printing area.

In this research, workplace spatial characteristics were categorized into two sets: individual workstation features and floor plan layout variables. In general, for predicting organizational outcomes, the impact of floor plan layout variables is stronger than workstation features. However, individual workstation variables have stronger influences than floor plan layout variables on sense of belonging.

Having flexibility to use space (always have available space, adequate types of space and suitable place) for different work needs (meetings, conversations or collaborative work) is significantly associated with commitment, work motivation, job satisfaction and work

performance. This confirmed the accessibility is one of the significant features of personal control in this research. Perceived availability to access the physical workplace to meet work needs is highly demanded for improving organizational outcomes. Similarly, short distance to services areas is clearly associated with work motivation, job satisfaction and work performance. This also reflects the concept of accessibility.

The five characteristics of an individual workstation that are significantly associated with sense of belonging are: large size workstation to hold face-to-face meetings; adequate storage space; high level of exposure to hearing colleagues talking or speaking on phone; high level of speech privacy; being able to personalize the workplace.

Having a large individual workstation and adequate storage space for work associate with the positive feeling of being valued by the company and add self-confidence of background. However, these features may challenge the cost saving and project-based work.

Speech exposure describes a passive interaction with the surroundings, which is helpful in reducing the feeling of misfit in social situations. Having speech privacy emphasizes the positive way for isolating interactions from the outside, which can be achieved by increasing the rate of architectural enclosure, i.e. equipping a door, providing higher dividers, or a higher number of partitions.

Being able to personalize reflects the needs for modifying. This is another essential feature of personal control according to the definition of personal control used in this research. Some organizations do not allow the employees to personalize their workplace in order to keep uniformity, strengthen the brand itself and weaken the individual impression. However, from an employee-centered point of view, the policy of allowing people to decide the appearance of their workplace is essential. According to this, movable and adjustable furniture and devices are welcome in workplaces. Areas where one can display their personal icons should be supplied in the form of shelves or pin boards. Different textures and interior colors are also helpful in increasing the perception of personalization.

### **6.3 Demographic influences**

Analysis of variance (ANOVA) was performed. It found significant interactions between:

- Gender and sense of belonging (SB3:  $F = 4.309$ ,  $p < 0.039$ ; SB4:  $F = 6.475$ ,  $p < 0.012$ );
- Gender and satisfaction with ambient physical environment ( $F = 4.789$ ,  $p < 0.30$ );
- Gender and visual privacy ( $F = 5.804$ ,  $p < 0.017$ ).

In general, male workers perceive higher level of sense of belonging, higher level of satisfaction with ambient physical environment, and higher level of visual privacy at their

workplace than female workers. According to this difference, it is crucial to create a workplace where the overall sense of belonging and environmental satisfaction meets women's demands. There are two direct and effective ways to improve female employees' sense of belonging: providing adequate storage space; locating women where there is a higher level of speech privacy.

What's more, female employees are more sensitive to visual privacy than male employees. Therefore, it is necessary to locate women in places where there is less visual exposure, i.e., keep a distance from traffic zones; avoid circulation passing through working areas; determine desk orientation well; use plants, paintings or furniture to build up a visual barrier.

ANOVA also presented significant interactions between:

- Work type and organizational commitment ( $F = 3.836$ ,  $p < 0.002$ );
- Work type and speech privacy (SP1:  $F = 2.769$ ,  $p < 0.019$ ; SP2:  $F = 2.899$ ,  $p < 0.015$ ).

Not surprisingly, those who work in managerial or executive positions, have a higher level of organizational commitment and higher level of speech privacy than people who work in other types within an organization.

The significant interactions were also found between:

- Age and personalization ( $F = 3.255$ ,  $p < 0.013$ );
- Age and Speech privacy ( $F = 6.740$ ,  $p < 0.000$ );
- Age and perceived amount of available space within workplace ( $F = 8.094$ ,  $p < 0.000$ ).

The young employees present a stronger desire to personalize their workplace than the older ones. However, they always feel having enough space within their workplace than older employees. Furthermore, young workers have lower demands on speech privacy than older employees. Based on these results, young people are suitable to work in relatively large and open place with more personalization space. Older workers show a strong interest in working in a relatively enclosed space that is big in size and has enough speech privacy.

According to the results of ANOVA, age has not been found to have a significant interaction with the sense of belonging, ambient environment satisfaction or organizational outcomes.

Length of employment in a particular organization and at a particular workplace has not been found to have significant interaction with other factors in this research.

## **6.4 Design implications from Structural Equation Model analysis**

The present study draws attention to various spaces that provide sense of belonging and support organizational outcomes rather than focusing on workstation arrangement. This study concludes that an optimal workplace is where sense of belonging, overall satisfaction with ambient physical environment and organizational outcomes (organizational commitment, work motivation, job satisfaction, and work performance) are well achieved.

The design implications of the research results are presented in this study according to the revealed spatial characteristics that have significant impacts on sense of belonging and organizational outcomes. These strategies are followed in all type of offices with flexible spaces that allow floor layouts to be more sensitive to the organizational changes in size and structure.

### **6.4.1 Improving sense of belonging**

According to the research findings presented in the precedent sections, function distance, and visual dominance were found directly, significantly and positively influence the sense of belonging.

The short distances from individual workplace to public copy/print areas, kitchen or coffee zones, and supervisor/chief's office are helpful to increase the sense of belonging in a direct way. These service areas with enjoyable and comfortable furniture and facilities, pleasant color and texture, and close to individual work places are helpful to promote social interaction among employees, foster information flow, attract informal encounters and enhance work effectiveness. Additionally, they can be the potential places for collaborative work or can also be used for holding meetings. However, these places may cause distractions by noise or the frequent movement of people. Good enclosure should be provided to minimize the distractions, and to meet the multi-level of privacy needs.

Having direct visual contact to the outdoor view, and having visual accessibility to the circulation and the whole workplace are in high demand for obtaining a higher level of the sense of belonging. Moreover, having visual contact to outdoor view can increase people's visual comfort, relax or refresh their mind from long-lasting concentration, and decrease the stress level at work. Stress is one of the most common mental health problems at a workplace. It can reduce productivity, increase errors, and lead to job dissatisfaction and disloyalty, or even break down the organization. Spatial variables induce stress in several ways. For instance, open plan workplace layout may reduce employees' privacy. Therefore, providing visual dominance in a workplace is an effective approach to improve the sense of belonging and decreasing the stress level.

Interestingly, people who have a high level of visual dominance over the whole workplace and an outdoor view, declared general satisfaction; having enough space for storage; having availability for holding face-to-face meeting at their workstation; having suitable type of space for conversation and meetings as needed. In order to achieve better visual dominance at a workplace, the relationship between window, door, workplace arrangement, and workstation orientation and location should be well thought through (an example in Figure 6.10).

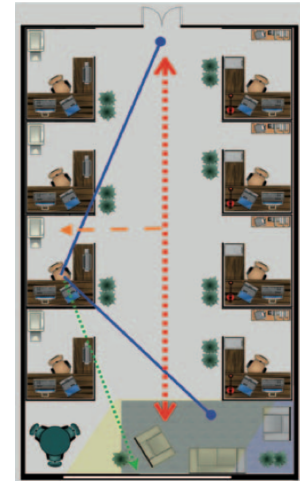


Figure 6.10 An example of workplace visual dominance  
Source: Wang, 2011

#### 6.4.2 Enhancing organizational outcomes

The mediating role of sense of belonging between workplace spatial features and organizational commitment, work motivation, job satisfaction and work performance has been partially confirmed in this study. Consequently, the design approaches for improving the sense of belonging are applicable for improving organizational outcomes.

Particularly, the ‘function distance to service spaces’ directly and significantly affects **organizational commitment**.

According to the research findings, architectural workplace features have not been found directly affecting **work motivation**. However, the ambient environment satisfaction is positively associated with work motivation. Thus work motivation can be indirectly improved by increasing the perceived level of the sense of belonging and the satisfaction with ambient physical work environment.

This study supports previous researches’ findings that employees’ satisfaction with ambient physical work environment is significantly related to the degree of being allowed to personalize their workplace. Furthermore, personalization helps to express identity, status and organizational policy in an organization. It is one of the methods for creating symbolic space. Being able to personalize one’s workplace could help to state ‘my space’. It transmits and mediates social norms and cultural norms in an organization. Also, being able to personalize is a very important communicator of organizational culture and values. Personalization areas in a workplace can be created by providing bookshelves, surfaces can be tacked or have distinct color/texture, and by providing furniture that can be easily adjusted, altered and moved by the employee.

The present research reveals that having the capability to use space flexibly, having a large amount of available space within an individual workstation, and greater proximity from the



neighboring workstation, influence employees' **job satisfaction** in a direct and positive way. Also, the overall satisfaction with the physical environment is positively associated with job satisfaction. Suitable spots are expected to be available and easily accessible for small or large group collaboration and for casual conversation whenever needed. These strategies aim to provide the employees with more options to choose an appropriate and pleasant place to work, and encourage them to use the space in an effective way. Locating the main circulation between the lines of workstations instead of crossing workstations in rows or centralizing work area is helpful to create a greater proximity from the neighboring workstation and to reduce the distractions.

In order to improve **work performance**, providing the capability of flexible use of space for work needs is a direct and effective strategy, beyond improving sense of belonging. The ability of use space flexibly can be achieved by creating a space spectrum from individual concentration to group collaboration, and finally reach the public shared spaces. Distributing the meeting and group work areas to the neighborhood of workstations with high visibility and ready for differential work needs.

## 6.5 Research limitations and future researches

One important limitation of this study is the limited type of workplace included in the field survey. This research was conducted in cellular offices with one to six workers working in the same room. This may have reduced the probability of substantial findings concerning speech privacy that may affect the sense of belonging and organizational outcomes. The findings of this research did not detect speech privacy influence the dependent variables at any level, which are contrary to the previous research findings. Further research could involve other types of workplaces, like open-plan workplaces and combination workplaces, to see if a stronger correlation develops.

A second limitation is that the factor examined in the research model might not have been sufficiently measured by the indicators. For instance, some of the dependent variables, like organizational commitment, work performance and satisfaction with ambient physical environment relied on only one measurement. The limited number of measurement might have decreased the power of statistic analysis as well. Future research could be improved by testing commitment, perceived work performance, and ambient environment satisfaction from multidimensional perspectives.

An additional limitation of the present study is the ignorance of the possible influences of location. This research was carried out only in Dresden. The life and work conditions from

other parts of Germany might vary from the same in Dresden. In order to minimize or isolate the possible effects of location, conducting the same study in other areas of Germany at the same time.

## **Appendices**

### **A – 1**

#### **Original questionnaire – English version**

The purpose of this study is to access office workers' experience with regard to workspace settings. The following questionnaire consists of four parts, and will take approximately **10 minutes** to complete. It is our intention that your opinions will be incorporated in the decision-making process for future improvement of your workspace. I assure you all the data will be treated confidentially.

#### PART I. WORKSPACE EXPERIENCE

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I can keep my work within arm's reach.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. There is sufficient storage space for my work in my workstation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. There is adequate space in my workstation to hold face-to-face meeting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. There are sufficient types of places for different conversation or meeting needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. There is always a meeting room/space available when I need it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I can always find a suitable place for certain type of conversation or collaborative work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I can decide the appearance of my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I can personalize my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I can rearrange the furniture and computer to a suitable place in my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I can see both entire room and outdoor view from my workstation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I can see entire room but I <u>cannot see outdoor view</u> from my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I can see outdoor view but I <u>cannot see entire room</u> from my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Everybody can see my computer screen at any time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Others can see my workstation when they stand up.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. People passing by can always see my work area and what I am doing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Only my coworkers from my group can see my work area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Nobody can see my computer screen except me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. I can hear my colleagues clearly when they are calling or talking to other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. People can hear me when I speak on the phone or talk to others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I have enough speech privacy in my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. I can close the door or adjust the partition to keep the noise outside of my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. I can contain the sound within my workstation when I speak on the phone or talk to others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. My workplace is close to the copier/printer area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. My workplace is close to the kitchen or coffee area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. My workplace is close to the supervisor's office.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. I am satisfied with the ambient environmental conditions in my workspace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Please continue on the other side. →**

**Part II. Work Motivation**

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I have a clear idea of future development steps of my department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I always enjoy working and performing my best.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It always nice to come to work everyday.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. My work makes me feel self-fulfillment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Part III. Job Satisfaction**

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I would like to recommend my job to a friend who was qualified and searching for a job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If I had to do it over, I would choose to work here again.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I'm satisfied with current job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Part IV. Sense of Belonging**

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am just not sure if I fit in with my colleagues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I would describe myself as a misfit in most social situations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I would like to make a difference to people or things around me, but I don't feel that what I have to offer is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I don't feel that there is anyplace where I really fit in this organization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I am uncomfortable that my background and experiences are so different from those who are usually around me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I am not valued by or important to my boss.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Part V. Organizational Commitment**

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I have strong commitment to my department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Please continue on the other side. →**

**Part VI. Work Performance**

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I always accomplish my individual work efficiently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**PART VII. DEMOGRAPHICAL INFORMATION**

1. How long have you been working in this organization?      Year      Months
2. How long have you been working in current office or cubicle?      Year      Months
3. What is your gender?    ☐ Female    ☐ Male
4. How would you describe the work you do?
 

<input type="checkbox"/> Executive/Managerial	<input type="checkbox"/> Research & development
<input type="checkbox"/> Professional/Technical	<input type="checkbox"/> Communication
<input type="checkbox"/> Creative/inventive	<input type="checkbox"/> Other (Please specify)
5. What is your age?
 

<input type="checkbox"/> Under 20 years	<input type="checkbox"/> 40 to 49 years
<input type="checkbox"/> 20 to 29 years	<input type="checkbox"/> 50 to 60 years
<input type="checkbox"/> 30 to 39 years	<input type="checkbox"/> 60 years old or over

**Thank you so much for your participation!**

**A – 2**

**Original questionnaire – German version**

Das Ziel dieser Studie ist es, auf die Erfahrung von Büroangestellten in Bezug auf die physischen Gegebenheiten ihres Arbeitsortes zuzugreifen. Der folgende Fragebogen besteht aus vier Teilen und wird in etwa **10 Minuten** in Anspruch nehmen. Es ist unser Bestreben, dass Ihre Meinungen in den Entscheidungsprozess für zukünftige Verbesserungen Ihres Arbeitsortes einfließen. Ich kann Ihnen versichern, dass alle Daten vertraulich behandelt werden.

**Teil I. ERFAHRUNGEN AM ARBEITSPLATZ**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen Sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen, die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich kann meine Arbeit eine Armlänge von mir entfernt aufbewahren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Es gibt genug Stauraum für meine Arbeit an meinem Arbeitsplatz.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Es gibt genug Raum an meinem Arbeitsplatz, um ein Treffen von Angesicht zu Angesicht durchführen zu können.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Es gibt ausreichend Räume für verschiedene Konversations- oder Meeting Bedürfnisse.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Es steht immer ein Ort für ein Treffen zur Verfügung, wenn ich einen benötige.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ich kann stets einen geeigneten Ort für ein Gespräch oder eine Zusammenarbeit finden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Ich kann das Aussehen meines Arbeitsplatzes entscheiden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Ich kann meinen Arbeitsplatz persönlich gestalten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Ich kann Möbel und Computer an meinem Arbeitsplatz an die passende Stelle bringen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Ich kann von meinem Arbeitsplatz aus sowohl den ganzen Raum überblicken, als auch nach draußen sehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Ich kann von meinem Arbeitsplatz aus den ganzen Raum überblicken, aber nicht nach draußen sehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Ich kann von meinem Arbeitsplatz aus nach draußen sehen, aber nicht den ganzen Raum überblicken.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Jeder kann zu jeder Zeit meinen Bildschirm einsehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Andere können meinen Arbeitsplatz einsehen, wenn sie aufstehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Leute die vorbeigehen können stets meinen Arbeitsbereich und was ich tue sehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Nur Mitarbeiter meiner Gruppe können meinen Arbeitsbereich einsehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Mein Computerbildschirm ist nur für mich einsehbar.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Ich kann meine Kollegen deutlich hören, wenn sie Anrufe machen oder mit anderen Leuten sprechen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Ich kann die Tür schließen, um Geräusche draußen zu halten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. Leute können mich hören, wenn ich telefoniere oder mit anderen spreche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. Ich habe genug sprach privatsphäre im meine Arbeitsplatz.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Ich kann die Geräusche an meinem Arbeitsplatz halten, wenn ich telefoniere oder mit anderen spreche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. In der Nähe meines Arbeitsplatzes befindet sich ein Kopierer/Drucker.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. In der Nähe meines Arbeitsplatzes befindet sich eine (Gemeinschafts-) Küche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. In der Nähe meines Arbeitsplatzes befindet sich Fachbereichsleiter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Ich bin mit den Umgebungsbedingungen meines Arbeitsplatzes zufrieden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Bitte fahren Sie auf der anderen Seite fort. →**



**Teil II. ARBEITSMOTIVATION**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich habe eine klare Vorstellung von zukünftigen Entwicklungsschritten meiner Abteilung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Ich genieße es, stets zu arbeiten und mein Bestes zu geben.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Es ist immer schön zur Arbeit zu kommen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Meine Arbeit verschafft mir Erfüllung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Teil III. Arbeitszufriedenheit**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich würde meinen Job einem Freund empfehlen, der dafür qualifiziert ist und gerade einen Job sucht.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Wenn ich mich noch mal entscheiden könnte, würde ich immer wieder hier arbeiten wollen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Ich bin mit meiner jetzigen Arbeit zufrieden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Teil IV. GEFÜHL DER ZUGEHÖRIGKEIT**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich bin mir einfach nicht sicher, ob ich zu meinen Kollegen passe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Ich würde mich selbst in den meisten sozialen Situationen als Außenseiter beschreiben.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Ich würde mich gerne bei Menschen und Dingen in meiner Umgebung einbringen, habe jedoch nicht das Gefühl, dass das, was ich zu geben habe, geschätzt wird.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Ich glaube, dass es keinen Ort auf dieser Organisation gibt, an den ich wirklich passe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Ich fühle mich unwohl, weil mein Hintergrund und meine Erfahrungen sich so von denen der Leute, die mich normalerweise umgeben, unterscheiden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ich bin meinem Chef nicht wichtig und werde nicht geschätzt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Teil V. Leistungsbereitschaft**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich engagiere mich stark für meine Abteilung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Bitte fahren Sie auf der anderen Seite fort. →**

**Teil VI. Arbeitsleistung**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
Bitte diese auswählen, die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich führe meine eigene Arbeit immer effizient durch.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Teil VII. DEMOGRAPHISCHE INFORMATIONEN**

1. Wie lange arbeiten Sie bereits für diese Organisation?      Jahre      Monate
2. Wie lange arbeiten Sie bereits in Ihrem jetzigen Büro oder Abteilung?      Jahre      Monate
3. Was ist Ihr Geschlecht?    ☐ weiblich      ☐ männlich
4. Wie würden Sie die Arbeit, die Sie machen, beschreiben?
 

<input type="checkbox"/> leitend/managend	<input type="checkbox"/> Forschung & Entwicklung
<input type="checkbox"/> fachlich/technisch	<input type="checkbox"/> Kommunikation
<input type="checkbox"/> kreativ/erfinderisch	<input type="checkbox"/> andere (Bitte angeben)
5. Wie alt sind Sie?
 

<input type="checkbox"/> Unter 20 Jahre	<input type="checkbox"/> 40 bis 49 Jahre
<input type="checkbox"/> 20 bis 29 Jahre	<input type="checkbox"/> 50 bis 60 Jahre
<input type="checkbox"/> 30 bis 39 Jahre	<input type="checkbox"/> 60 Jahre oder älter

**Vielen Dank für Ihre Teilnahme!**

**B – 1**

**Developed questionnaire – English version**

The purpose of this study is to access office workers' experience with regard to workspace settings. The following questionnaire consists of four parts, and will take approximately **10 minutes** to complete. It is our intention that your opinions will be incorporated in the decision-making process for future improvement of your workspace. I assure you all the data will be treated confidentially.

#### PART I. WORKSPACE EXPERIENCE

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I can keep my work within arm's reach.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. There is sufficient storage space for my work in my workstation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. There is adequate space in my workstation to hold face-to-face meeting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. There are sufficient types of places for different conversation or meeting needs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. There is always a meeting room/space available when I need it.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I can always find a suitable place for certain type of conversation or collaborative work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I can decide the appearance of my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I can personalize my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I can rearrange the furniture and computer to a suitable place in my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I can see both entire room and outdoor view from my workstation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I can hear my colleagues clearly when they are calling or talking to other people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. People can hear me when I speak on the phone or talk to others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. I have enough speech privacy in my workplace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. My workplace is close to the copier/printer area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. My workplace is close to the kitchen or coffee area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. My workplace is close to the supervisor's office.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. I am satisfied with the ambient environmental conditions in my workspace.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Part II. Work Motivation

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I have a clear idea of future development steps of my department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I always enjoy working and performing my best.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. It always nice to come to work everyday.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. My work makes me feel self-fulfillment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Please continue on the other side. →**

### Part III. Job Satisfaction

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I would like to recommend my job to a friend who was qualified and searching for a job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If I had to do it over, I would choose to work here again.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I'm satisfied with current job.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Part IV. Sense of Belonging

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I am just not sure if I fit in with my colleagues.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I would describe myself as a misfit in most social situations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I would like to make a difference to people or things around me, but I don't feel that what I have to offer is valued.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I don't feel that there is anyplace where I really fit in this organization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I am uncomfortable that my background and experiences are so different from those who are usually around me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I am not valued by or important to my boss.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Part V. Organizational Commitment

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I have strong commitment to my department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Part VI. Work Performance

**Instruction:** Here are some statements with which you may or may not agree. Please *choose the most closely reflects your feelings* about each statement.

Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I always accomplish my individual work efficiently.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Please continue on the other side. →**

**PART VII. DEMOGRAPHICAL INFORMATION**

1. How long have you been working in this organization?      Year      Months
2. How long have you been working in current office or cubicle?      Year      Months
3. What is your gender?      ☐ Female      ☐ Male
4. How would you describe the work you do?
  - ☐ Executive/Managerial
  - ☐ Professional/Technical
  - ☐ Creative/inventive
  - ☐ Research & development
  - ☐ Communication
  - ☐ Other (Please specify)
5. What is your age?
  - ☐ Under 20 years
  - ☐ 20 to 29 years
  - ☐ 30 to 39 years
  - ☐ 40 to 49 years
  - ☐ 50 to 60 years
  - ☐ 60 years old or over

**Thank you so much for your participation!**

**B – 2**

**Developed questionnaire – German version**

Das Ziel dieser Studie ist es, auf die Erfahrung von Büroangestellten in Bezug auf die physischen Gegebenheiten ihres Arbeitsortes zuzugreifen. Der folgende Fragebogen besteht aus vier Teilen und wird in etwa **10 Minuten** in Anspruch nehmen. Es ist unser Bestreben, dass Ihre Meinungen in den Entscheidungsprozess für zukünftige Verbesserungen Ihres Arbeitsortes einfließen. Ich kann Ihnen versichern, dass alle Daten vertraulich behandelt werden.

**Teil I. ERFAHRUNGEN AM ARBEITSPLATZ**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen Sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen,* die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich kann meine Arbeit eine Armlänge von mir entfernt aufbewahren.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Es gibt genug Stauraum für meine Arbeit an meinem Arbeitsplatz.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Es gibt genug Raum an meinem Arbeitsplatz, um ein Treffen von Angesicht zu Angesicht durchführen zu können.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Es gibt ausreichend Räume für verschiedene Konversations- oder Meeting Bedürfnisse.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Es steht immer ein Ort für ein Treffen zur Verfügung, wenn ich einen benötige.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ich kann stets einen geeigneten Ort für ein Gespräch oder eine Zusammenarbeit finden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Ich kann das Aussehen meines Arbeitsplatzes entscheiden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Ich kann meinen Arbeitsplatz persönlich gestalten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Ich kann Möbel und Computer an meinem Arbeitsplatz an die passende Stelle bringen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Ich kann von meinem Arbeitsplatz aus sowohl den ganzen Raum überblicken, als auch nach draußen sehen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Ich kann meine Kollegen deutlich hören, wenn sie Anrufe machen oder mit anderen Leuten sprechen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Ich kann die Tür schließen, um Geräusche draußen zu halten.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Leute können mich hören, wenn ich telefoniere oder mit anderen spreche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. In der Nähe meines Arbeitsplatzes befindet sich ein Kopierer/Drucker.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. In der Nähe meines Arbeitsplatzes befindet sich eine (Gemeinschafts-) Küche.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. In der Nähe meines Arbeitsplatzes befindet sich Fachbereichsleiter.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Ich bin mit den Umgebungsbedingungen meines Arbeitsplatzes zufrieden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Teil II. ARBEITSMOTIVATION**

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen* die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich habe eine klare Vorstellung von zukünftigen Entwicklungsschritten meiner Abteilung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Ich genieße es, stets zu arbeiten und mein Bestes zu geben.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Es ist immer schön zur Arbeit zu kommen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Meine Arbeit verschafft mir Erfüllung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Bitte fahren Sie auf der anderen Seite fort. →**



### Teil III. Arbeitszufriedenheit

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen* die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich würde meinen Job einem Freund empfehlen, der dafür qualifiziert ist und gerade einen Job sucht.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Wenn ich mich noch mal entscheiden könnte, würde ich immer wieder hier arbeiten wollen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Ich bin mit meiner jetzigen Arbeit zufrieden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Teil IV. GEFÜHL DER ZUGEHÖRIGKEIT

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen*, die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich bin mir einfach nicht sicher, ob ich zu meinen Kollegen passe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Ich würde mich selbst in den meisten sozialen Situationen als Außenseiter beschreiben.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Ich würde mich gerne bei Menschen und Dingen in meiner Umgebung einbringen, habe jedoch nicht das Gefühl, dass das, was ich zu geben habe, geschätzt wird.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Ich glaube, dass es keinen Ort auf dieser Organisation gibt, an den ich wirklich passe.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Ich fühle mich unwohl, weil mein Hintergrund und meine Erfahrungen sich so von denen der Leute, die mich normalerweise umgeben, unterscheiden.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Ich bin meinem Chef nicht wichtig und werde nicht geschätzt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Teil V. Leistungsbereitschaft

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen*, die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich engagiere mich stark für meine Abteilung.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Bitte fahren Sie auf der anderen Seite fort. →**

### Teil VI. Arbeitsleistung

**Anweisungen:** Hier finden Sie einige Aussagen, mit welchen sie überein- oder auch nicht übereinstimmen werden.  
*Bitte diese auswählen*, die Ihre Meinung am ehesten widerspiegelt.

Aussage	stimme absolut nicht zu	stimme nicht zu	stimme zu	stimme voll und ganz zu
1. Ich führe meine eigene Arbeit immer effizient durch.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Bitte fahren Sie auf der anderen Seite fort. →**

**Teil VII. DEMOGRAPHISCHE INFORMATIONEN**

1. Wie lange arbeiten Sie bereits für diese Organisation?                      Jahre                      Monate
2. Wie lange arbeiten Sie bereits in Ihrem jetzigen Büro oder Abteilung?                      Jahre                      Monate
3. Was ist Ihr Geschlecht?    ☐ weiblich                      ☐ männlich
4. Wie würden Sie die Arbeit, die Sie machen, beschreiben?  

☐ leitend/managend  
☐ fachlich/technisch  
☐ kreativ/erfinderisch

☐ Forschung & Entwicklung  
☐ Kommunikation  
☐ andere (Bitte angeben)
5. Wie alt sind Sie?  

☐ Unter 20 Jahre  
☐ 20 bis 29 Jahre  
☐ 30 bis 39 Jahre

☐ 40 bis 49 Jahre  
☐ 50 bis 60 Jahre  
☐ 60 Jahre oder älter

Vielen Dank für Ihre Teilnahme!

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